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PUBLIC HEALTH ASPECTS OF ATOM BOMB ATTACK

With Special Reference to Chicago¹

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We may classify the purely medical phases² of a Civilian Defense Program against the ravages of an atomic bomb attack into:

1. The *prophylactic* or preventive, i.e., those measures to be instituted *before* the attack takes place, such as the necessary planning, organization, training, stockpiling, and immunization.

2. The *immediate*, i.e., the measures to be instituted as soon *after* the disaster as possible. These refer mainly to the First Aid and Hospitalization care of the wounded, burned, and those exposed to radiation.

3. The *delayed*, i.e., measures of less urgency whose introduction, although important, can be delayed until some time or even several days after the holocaust—time for the general confusion, mass hysteria, and wild fleeing to calm down; or, if immediate, pertain to areas outside of the actually damaged areas. These are the epidemiological, public health, and sanitary aspects.

Of course, the prophylactic measures are the very base on which the proper

introduction and use of the other remedial and therapeutic measures depend. Intelligent plans for a complete defense can only be based on a full knowledge of the potentialities possessed by the attacker and *his plans* for using the means which he has available. At the present, to a large measure, the prophylactic planning is based upon one unknown factor piled upon another. Although much basic rational planning and organization can and has been done, this planning is an extremely fluid condition at the present time due to these many unknowns. Some of them are completely out of the control of the local civil defense organizations: viz., *when* is war to be expected? how many atom bombs will the enemy be likely to possess at that time and how many are apt to be dropped on targets in the Chicago area? *where* are they most likely to be dropped and at what altitude will they be exploded to achieve maximum damage? can the sections of the atom bomb be brought into the area piecemeal, assembled locally, trucked into the city, and detonated on the ground by saboteurs? Yet much of the

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1. Abstracted from lecture presented at Mt. Sinai Hospital, Chicago, Ill., on Dec. 6, 1950.

2. In addition to the medical phases, the civilian defense organization consists of many other sections, e.g., Headquarters and Administration (coordination, direction, public information, education and training, legal and budget, manpower, liaison, procurement and supply, planning); Public Works (utilities, communications, fuel, water, sewers, clearance and rescue, refuse and

rubble disposal, sanitary engineering); Engineering and Public Service (traffic, evacuation and transportation, demolition and debris clearance, protective shelters); and Public Safety (firefighting, police, wardens, and air-raid warnings). Several of these have duties which border upon the medical and public health functions. The Medical Services, Public Health and Welfare Section, the most complex of all, consists of Medical Rescue, Public Health Services, Nursing Services, Hospital Supplies, Registry and Records, Mortuary Services, Identification of Victims, Welfare, Post-Raid Evacuation, Shelter and Housing, Feeding and Clothing, Salvage, Financial Assistance, Reclamation, and, under Special Services, Radiological detection (monitoring) and decontamination, radiological treatment, and biological hazards.

medical and first aid planning being done³ is based on just such intangibles.

The medical program does not concern us here except insofar as it is reflected in the public health phases⁴. In a broad sense, many of the medical phases are public health, and the line of demarcation is not sharp. Likewise, many of the engineering and welfare phases are also public health. In this talk, we will restrict our discussion to selected topics. For example, radiological detection (monitoring) is an important public health problem but, because of its specialized nature, is handled by special squads; hence, it will not be considered here.

The major public health problems which will arise following an atomic attack on Chicago may be classified as: 1) water supply; 2) sewage; 3) vermin problems (insect-borne diseases, insect and rodent pests); and 4) communicable diseases. The engineering aspects of the two former subjects will not be discussed.

3. At present, the organization of the medical program of the Chicago Civil Defense Corps is being done by the Division of Emergency Medical Services and Council on Medical Care and Public Health, under Dr. H. N. Bundesen, Chief of the Chicago Board of Health and Drs. E. E. Irons and A. C. Ivy, Vice Chief Deputies. There are some twenty-four committees and sub-committees in this council, each with a specific scope of operation. All these subcommittees have the function of appraising the hazards and organizing the prophylactic measures to be set up. They consider not only problems of atomic attack but also chemical and biological attacks. Many of the groups, e.g., Medical Defense Information; Emergency Medical Services (medical and surgical services, registry and records, transportation, blood and blood substitutes, nursing services, emergency stations and hospitals); Committees on Standard Therapies (treatment of diseases due to biological agents, radiation, poison gases, and chemical burns, and psychiatric casualties); Medical Rescue; etc. do not concern us here. The work of the committees of Emergency Public Health, Public Sanitation, and Prevention of Biological Hazards falls within the limits of the scope of this talk.

As complete as this program is at the present, there seems to be no special provisions, so far, for planning to control Laboratory Services, Industrial Health, Veterinary Services (including the zoos), nor Nutrition Services for the general population of the disaster areas.

4. The immediate first aid and hospitalization program is based on the premise that one or several bombs will be dropped in the loop area, on the far north side, and on the far south side of the city. Thus will be inflicted the greatest damage to the city's financial and commercial life as well as hitting at the greatest concentration of population, industry, and transportation lines and disruption of communication, along with causing the greatest confusion and hindrance to the civil defense effort. Up to 130,000 dead and 130,000 injured may be expected with, perhaps, up to 200,000 requiring first aid treatment and hospitalization.

The circle of damage will be a radius of $1\frac{1}{2}$ to 2

1. WATER

The importance of water, not only for its domestic drinking, culinary and washing purposes, but also for its fire-fighting, sewage carriage, and industrial uses, cannot be overestimated. The basic considerations in water supply are both *quantity* and *safety*. Maintenance of a potable water supply in sufficient quantity for the manifold needs is a serious problem. A minimum of 1 gallon of potable water per day per person is the absolute minimum under emergency conditions.

Lake Michigan is the main source of water for Chicago^{5,6}. Here, the problem of water potability is not primarily one of radioactivity but rather that of bacterial contamination. The danger of the Lake's becoming dangerously radioactive and unusable is not great nor grave, following an air-burst or a ground-burst of the bomb. The amount of radioactive material required to contaminate such a water mass is much greater than the amount which would fall on the water

miles from point ZERO, i.e., the spot directly under the bomb burst. Since the chances of survival of anyone within a $\frac{1}{4}$ -mile radius are almost nil, this area is forgotten. The chances of those within a $\frac{1}{2}$ to 1 mile radius are slim; those from 1 mile outward stand some chance depending upon their distance and exact location and on the type clothing they are wearing. Hence, first aid is supplied to those in the outermost areas first and then work progresses inward towards the center as the chances of survival decrease with centripetal progress.

The organization of the actual rescue operations—the mobilization of the teams, the radiological monitoring, the advance of the demolition squads, the delimiting of the safe areas with markers or flares, etc., are complex. The wounded, however, will be brought to first-aid stations outside the blighted areas. These casualty stations will be located in all available theaters, halls, churches, fire stations, bowling alleys, etc., which can accommodate 50 or more litters. Here the wounded will be given emergency treatment and classified into wounded, shocked, hysterical, radiologically exposed, etc. They will then be sent to refugee camps, hospitals, convalescent stations, etc., as their condition warrants.

5. Scattered throughout the city there are numerous wells which could, in an emergency, be used as secondary sources of water. These wells, usually privately owned and installed, are used for water supply in air-conditioning systems, swimming pools, breweries, milk plants and other types of industrial establishments utilizing large quantities of water.

6. The Waterworks Operating Division operates the city's 12 dispersed water pumping stations and 4 water intake cribs; the Water Purification Division operates the district filtration plants and has control over water safety, i.e., the actual chlorination operations and emergency chlorination applied to local areas. The Water Pipe Extension Division builds, controls, and repairs the water distribution system. After an atomic attack, it will be the duty of this last named group to isolate the destroyed area by shutting off the main valves.

following these types of bursts. However, following an underwater-burst, the danger is greatly increased⁷. Neither is it expected that, except in the immediate vicinity of a ground-burst, the water pipes or their contained water will be made sufficiently radioactive to constitute a danger.

Monitoring can easily detect radioactive contamination in the water. Precipitation and filtration which removes most of the particulate matter suspended in water is the most practical method of water decontamination. Luckily, the newer systems of sedimentation and sand filters with their associated algal flora remove most of the radioactivity from reservoir waters. Water storage would be useful for short-lived isotopes but is impractical under many conditions and is useless for long-lived isotopes.

Boiling radioactive water as a method of decontamination is useless, and may, indeed, be harmful. The contaminants are not volatile and boiling will tend to concentrate them. Likewise chlorination of radioactively contaminated water is useless, as are most other practical chemical procedures.

Bacterial contamination⁸ is most serious. The danger is three-fold. Not only is there danger of contamination from breaks and leaks in the mains and lines but also, due to the fact that quantities of water in excess of the capacity of the treating plants may be needed for fire-fighting, raw untreated water may be pumped into the system despite the health danger. In addition, back siphonage from building fixtures due to reduced, zero, or negative pressures in the water mains in either the disaster or nearby areas can draw sewage or toilet wastes

into the water lines. Chicago, due to the high percentage of antiquated plumbing arrangements, is especially prone to such an action.

Except in the immediate vicinity of an air-burst, water mains will not be broken for any large areas. The ground, due to its tremendous mass, absorbs most of the shock. Water mains, for the most part, are buried sufficiently deeply so that they will be only slightly affected. However, there will be moderate to heavy leakage from broken service lines and plumbing for up to 1½ miles from point ZERO. Following a ground burst, however, which will leave a depressed crater 50 feet deep and 1000 feet across, it may be expected that all the mains (24 inch and 36 inch diameters) and laterals (6 inch to 16 inch lines) for 1/2 mile will be seriously damaged, as well as, of course, the service lines and plumbing in the damaged buildings. In isolating the peripheral area of major damage (termed the "C" area⁹), all the main water valves (up to 200 individual valves along the 13½ mile perimeter surrounding this area) on all pipes leading into the area must be shut. Then to supply needed water to the area for fire-fighting, sufficient cross connections from outlying areas must be opened.

To maintain a potable water quality in the still usable residences, restaurants, and other commercial establishments in the affected area, it will be necessary to check all water supplies bacteriologically, and all plumbing, mains, and service lines for leaks. Until that is done, the chlorination rate in the water being fed to the affected areas should be increased so that a residual of at least 1.0 p.p.m. of free chlorine after 15 minutes contact is maintained throughout the system and

7. Air-bursts at an optimum height (about 2500 ft. alt.) are used where it is desired to get the greatest blast effect and burn hazard over the widest area. Radiation injuries are the smallest. Ground-bursts are used where it is desired to cause the greatest radiation hazard. Here, the buildings shield the blast and the initial burn and radiation damage is low. However, the residual radioactivity is great and makes the area unusable for prolonged periods of time. Underwater-bursts will be used for creating a tidal wave to engulf the city with highly radioactive water, thereby causing, possibly, the greatest consternation and disruption of all.

8. Numerous debilitating enteric and systematic infections can be transmitted by contaminated water

supplies. The most important of these, typhoid and paratyphoid fevers and bacillary and amoebic dysenteries, are highly infective and, as the mass of population is not immune to any of them, great numbers of people can be infected at one time from one contaminated source.

9. Varying degrees of damage as a function of distance from point ZERO are expressed as concentrically ringed areas plotted on grid maps of the area. Area A is area of total destruction, having a radius of 0.5-0.7 miles from point ZERO depending on the type of burst; Area B is area destroyed beyond repair and extends from 0.5 to 1.3 miles; Area C is area of major damage and extends from 1.0 to 1.9 miles from point ZERO; while Area D is area of minor damage and extends from 1.4 to 3.2 miles from point ZERO.

right into the individual taps. This rate of chlorination should be increased at the same time that the air-raid warning signal is given. In addition, however, the householder should be warned to disinfect all water used for whatever domestic purpose by either boiling or by the use of hypochlorites (TTH, perchloron, chloride of lime, halazone, etc).

These leaks and breaks in the mains, laterals, service lines, and plumbing are only one way for bacterial contamination to enter the water system. The pressing need for large volumes of water for fire-fighting will require that water from any available source, be it lake, canal, rivers, or even sewers, be pumped into the distribution system to meet these demands. Disinfecting emergency fire supplies is not practical, so the possibility of contaminating the water lines is real. It will be necessary to isolate that part of the system into which such water is pumped. Moreover, the fire fighters in the area must be warned not to drink the pumping water; householders and others in the area must be warned to boil thoroughly all water before using for drinking, cooking, food washing, or toiletry purposes; and the lines must be thoroughly disinfected with high dosages of chlorine before being returned to normal water use after the fire-fighting has terminated.

Finally, consideration must be given to the problem of supplying potable water to the rescue squads, fire-fighters, and workers in the area, and the householders and refugee populations in surrounding areas. For these, use can be made of tank trucks, street cleaning, milk transport, or even gasoline trailers, to haul water into the area. These, of course, must be suitably cleaned and disinfected before use. In addition, a variety of portable field reservoirs, military and camping, can be used. These range in size from the old-style Lister bags to the collapsible thousand-gallon rubberized fabric or plastic tanks.

10. In Chicago, the sewer systems are under jurisdiction of the Bureau of Sewers whose job it is to restore the flow and keep open this system. The treatment of the sewage effluent is under the Sanitary District of Chicago, an independent municipal corporation with its own popularly elected board of trustees, with the function of protecting metropolitan Chicago's water supply from pollution by domestic sewage and indus-

2. SEWAGE AND GARBAGE¹⁰

Aside from the effect on the esthetic senses, proper disposal of sewage and garbage is essential to community health and functioning. Besides the breeding of vermin (flies, roaches, rats, etc.) which can act as carriers and reservoirs of pathogenic intestinal organisms and parasites, accumulations of human wastes lead to direct contamination of foods and drinks as well as secondary fomite contamination with these pathogens. Untreated industrial wastes lead to gross pollution of water courses and supplies. Hence, sewage, garbage, wastes and refuse must be removed. In addition, the sewers have the function of carrying off rain-water which otherwise would flood basements and other subterranean structures.

Luckily, however, the urgency of returning sewers to service is much less important than restoring water supply. In areas A, B, and C from point ZERO, i.e., in those areas of total destruction to major damage, the sewage load after detonation will be considerably less than normal due to the general evacuation of the areas and the closing down of most industries.

The amount of actual damage to be expected to the main sewers will depend on the type of bomb burst. The same statements may be made about this as were made about water mains. After an air burst little damage will result, except for clogging of street inlets by rubble and debris and silt washed into the sewers by water from broken water mains before the valves are shut off. After a ground-burst in which a crater 50 feet deep and 1000 feet across results, however, the sewer system in the area will be completely destroyed, pressed down flat into the form of a ribbon by the pressure. Nothing can be done about repairing this type of damage until the whole area is reconstructed. Thus, only if some of the main conducting ducts (9 feet in diameter) are hit directly by a ground-

trial wastes. At present, about one billion gallons of sewage daily is collected and treated. The District operates a network of widely dispersed pumping stations and treating plants throughout the city, as well as the main effluent gates in the Chicago River and Lake Michigan. Garbage collection is under the Bureau of Sanitation, divided on a city ward basis, and done by the Bureau as well as by various scavenger services.

burst will there be a serious problem. If a heavy rain occurs soon after a sewer destruction, the difficulties will be compounded.

On the whole, however, in Chicago, the system of interconnecting sewer lines is sufficiently developed so that a destroyed section can be blocked off and its normal load shunted to another sewer system. If necessary, accessory pumps may be installed to help this, aid a backflow, or pump the sewage over a ground rise. In other areas a ditch may be dug from the destroyed area to a natural surface drainage (creek, river, canal, etc.) and the raw sewage bypassed into this natural drainage. The resulting contamination is preferable to widespread flooding areas in which rescue and repair work must be carried out later.

If one of the pumping stations or treatment plants are put out of commission this may be bypassed and raw sewage fed into the final outlet directly. It is important only to notify downstream or neighboring communities what type and quantity of untreated sewage is being passed on to them. In any event, the flow of highly toxic sewage wastes from industrial plants must be stopped immediately if they cannot be treated due to either failure of the sewage system or the treating plant itself.

As with the case of water plumbing, in those areas where there is severe damage to structures, the toilet plumbing and service sewer lines will be damaged. A variety of substitute facilities will have to be resorted to:

a. Citizens can dispose of their excreta in temporary containers which subsequently could be treated chemically or dumped into emergency sewage disposal units.

b. Emergency pit latrines could be built. This type is particularly adapted to areas without water service, at reception centers, at emergency health and medical facilities, mass feeding centers, and other shelter areas. It is necessary to supply at least one sheltered latrine for men and one for women in each city block with at least one seat for each 25 persons. The latrines must be policed, i.e., inspected several times a day. The

contents of the pit latrines are to be covered with earth daily to prevent fly breeding and the access of vermin and stray animals to the excreta. In addition, quicklime sprinkled over the excreta will reduce odors and prevent fly breeding.

c. In heavily built up areas where all the ground is concrete paved, dug pit latrines cannot be used. In these cases, catch basins in the streets could be used to hold the excreta deposited directly in them.

In the period of reconstruction, major problems will be involved in retesting and repairing the sewage and toilet systems in damaged buildings in the blast area. Also, it will be necessary to decontaminate below-surface areas that might be flooded with sewage.

One of the lesser problems is that of garbage and trash collection. If necessary, these functions can be suspended for 7 to 10 days. Householders and merchants can do much to clean up and burn their own rubbish either in individual or communal incineration pits during the emergency period. Under no account, however, should the garbage be permitted to accumulate for longer than these periods due to the problem of fly breeding and vermin control.

3. INSECT AND RODENT PROBLEMS

We can classify the vermin problems into several distinct categories, each engendered by a different phase of the problem and each of which will require a different remedial measure; viz., flies and fly-borne diseases, skin parasitoses and ectoparasite-borne diseases, and rats and rodent-borne diseases.

(a.) *Flies*: Two distinct types of fly problems will be present. Their severity will depend upon the season of the year in which the catastrophe occurs. From the middle of the spring, throughout the summer and into the mid-autumn, the problems will be severe; in the winter, they will be practically non-existent.

1. The Breeding of Flesh Flies in Dead and Decaying Bodies.

Several families of large flies, the *Sarcophagidae*, *Calliphoridae*, and some *Muscidae*, are scavengers and breed habitually in exposed meat. They are known commonly as flesh flies, blowflies, green

or blue-bottle flies, houseflies and scavenger flies. At least 40 species are present in the Chicago area. The egg masses and maggots are common sights any place where meat has been left exposed for a few hours.

During the past war throughout the Pacific battle areas, such fly breeding in the dead bodies left on the battlefield was commonplace. The number of flies emerging after as little as a 4-5 day maturation period was prodigious. The fields and the nearby bivouacs swarmed with the emerged flies, which constituted a veritable scourge. In just one day, the bodies were left an unsightly, disformed mass of putrefying flesh by the crawling maggots. The stench and flies brought incessant demands for remedial measures.

We may expect the same general type conditions here in Chicago following an A-blast, scavenger and myiasis fly populations reaching pestiferous proportions. This time, two additional complications are bound to occur:

a. Bodies of both humans and animal pets will be buried in inaccessible places, buried under rubble, which will not only hamper and delay their excavation but will completely hide many bodies from the view of searchers. Also, the ruins themselves may be highly radioactive which will hinder clearing work. The flies, which have an exquisite sense of smell, however, will find them and begin breeding even though they are buried from view¹¹.

b. The flies emerging from bodies in the radioactive zones may be radioactive themselves¹². We cannot categorically state that these radioactive flesh-breeding flies constitute a flying danger themselves or will be dangerous as a result of their falling into drinking water. However, the possibility should be kept in mind.

In any case, the pest problem resulting from flesh flies will be severe enough to

warrant remedial control measures. The flies are best controlled by proper insecticidal application, i.e., larvicidal treatment, wherein the maggots are killed by spraying their breeding places (the bodies in which they are breeding) with insecticide.

During the past war and even now the Army and Marine Corps specifications called for a 56% solution of sodium arsenite. This is diluted to about 3% with water and sprayed on with a 3-gallon knapsack or decontamination-can sprayers. However, now, some of the newer chlorinated or phosphorous insecticides like benzene hexachloride, dieldrin, aldrin, or parathion are more efficient larvicides for killing fly maggots and can well be used for this purpose. The first named are especially valuable and can be used as dilute as 0.5-1.0% concentration.

The adult flies can also be controlled through either direct contact spraying with the same spray materials or through residual insecticide spraying, wherein the insecticide is deposited on the rubble and other resting places where the flies will land at some future date. Five per cent DDT in kerosene or water emulsion is especially valuable for this type of work.

The insecticides can be applied as a spray over the bodies with any type of larger spraying equipment, ranging from individually carried portable 5-gallon sprayers to airplanes. The various mosquito control abatement districts now in operation in the river valleys of the suburbs of Chicago, like the Des Plaines district, and the park districts, are plentifully supplied with large-scale high pressure truck-mounted tree sprayers, mist blowers, and aerosol fogging machines for this kind of control work. Their crews are already trained in the use and maintenance of this equipment and will undoubtedly be used. If necessary, plane spraying for fly control can be resorted

11. It is an old European exterminator's trick in locating the bodies of dead rats which have died inadvertently in inaccessible places, to release a few of these flesh flies and watch where they hover seeking an entrance. They locate at a spot over the body of the rat. Use of this principle could be made in locating dead bodies, i.e., the rescue squads could be on the lookout for congregations of these flies and start digging in the vicinity for victims.

12. We found here at The Chicago Medical School that small anthomyid flies breeding in the lead disposal jars on the bodies of sacrificed radioactive rabbits were themselves radioactive. The maggots in their feeding can probably concentrate many times the radioactivity of the flesh of their host which is then carried over unchanged into the adult fly. In the $\frac{1}{2}$ mile radius from point ZERO of a ground-burst, bodies will be "hot," as will the flies emerging from them.

to, as has already been done over the 48th Ward here in Chicago.

2. House Flies and Dysentery. Even more important than the flesh fly problem will be the house-fly problem and its concomitant mess-mates—epidemic dysenteries, and typhoid fever.

It is a well known fact, world-wide in distribution, that the incidence of various of the bacillary dysenteries (mainly *Shigella* and *Salmonella*), endemically and epidemically, is correlated with the population of *Musca domestica*, the common house-fly in the area. This is especially so in the infantile diarrheas of both urban and rural areas, but the various enteric infections attack adults as well. They are major military problems in the field, causing a high degree of morbidity and incapacity¹³. Epidemic outbreaks are characterized by sudden onset, explosive violence, high incidence, and slow remission. Positive proof of this view that flies play a major role in diarrheal disease is brought about by Watt and Lindsay's (1948) fine study in Southern Texas, wherein they controlled the flies with DDT and brought about a precipitous drop in the diarrhea rate.

Besides the *Shigella* and *Salmonella* enteric organisms, houseflies carry typhoid and paratyphoid and are an important factor in the transmission of amoebic dysentery, cholera, contagious conjunctivitis (pink-eye), trachoma, and anthrax, and undoubtedly play some role in transmitting poliomyelitis. In addition, they are the vectors of a wide variety of other bacterial, protozoal, and helminthic infections.

Flies will breed in many different types of decaying or fermenting organic matter. They lay their eggs and their maggots develop in slaughter-house offal, garbage, refuse, dirty waste paper, decaying vegetation, decaying meat, industrial and

cannery wastes, sawdust sweepings, sewage, and excreta or manure from many different types of animals including dogs, cats, horses, man, etc., and many other types of decaying organic materials. As they have a short life cycle of 8 to 12 days, or even less, have 5-8 generations per season, and produce large numbers of eggs, their population build-up is rapid and prodigious.¹⁴ They are, in some areas, true scourges. In the Near East they occur in such great numbers that they completely cover the face, hands, eyes and neck of all individuals, so that it is impossible to eat even one spoonful without actually eating flies which have landed on the food.

Here, we have the complete cycle: Breeding in garbage and excreta, the flies feed incessantly on any type of sugary or fermenting food. They are specifically attracted to these foods, fly directly to them, and begin their probing, regurgitating, and sucking type of feeding. The disease microorganisms are carried on the numerous hairs of the feet and the body, on the mouthparts, and swarm in myriad numbers in the gut, from whence they are excreted via the anus as the fly feeds. The pathogens are capable of living for several days to prolonged periods in these locations. Since the diarrheas are all transmitted via food, we have here our prime source of infection.

Chicago has a very high fly population, due for the most part to its inadequate garbage-collecting system and refuse-littered alleys, and the presence of large stock yards within the city limits. Although usually restricted to a ¼ mile radius zone of their breeding places, houseflies have a flight range of 2 to 7 miles, i.e., they are capable of migrating several miles to continuously reinfect sanitized areas. These conditions will not be ameliorated in the disorganization

were the one most important agent in the transmission of the disease.

13. Several campaigns during the past war were effectively stopped or delayed in both the Pacific area and the European theater by fly-borne dysentery outbreaks. The invasion of North Africa was delayed when 80 per cent of the 8th Division ready to sail from Fort Bragg in North Carolina came down with fly-borne fulminating diarrheas just before they embarked. But such examples could be extended ad nauseum not only for this war, but for all wars. as well as being continuously with us in all unsanitized communities of whatever size. Numerous epidemiological analyses of epidemic typhoid outbreaks have shown that house-flies

14. One female fly can lay up to 2500 eggs in its 30-day life. One pair of flies beginning in April might be progenitors, if all were to live, of 191,010,000,000,000,000 flies by August. Allowing ⅓ cubic inch to a fly, this number would cover the earth 47 feet deep with a weight of 96,000,000,000,000 metric tons. Hence the old adage, "Swat the first fly." The fact that insect pests, or any other living organism, do not reproduce in any such algebraic progression is the most vivid proof of the struggle for existence in nature.

following an atomic attack and we may expect an increase in fly-borne dysenteries.

Fly control is a two-faced problem: prophylactic, in preventing the breeding of flies in the first place, via screening, proper sewage disposal, garbage collection and disposal, and general sanitation¹⁵, and therapeutic, or fly eradication by insecticides. Destruction of part of the sewage system in the city, as well as an even worse garbage-collection disorganization as a result of the A-bomb attack, probably will cause an increase in flies and at the same time prevent our using the control measures against them.

We are, however, in a favorable position when it comes to using insecticides. Flies (the non-resistant strains) are extremely sensitive to DDT. They are killed by either contact with a direct spray or with a residual deposit. A residual deposit of 5% DDT when applied to walls or other places on which flies rest, causes their death in a short period of time and such a deposit retains its effectiveness for several weeks. The drawback to this procedure is that the flies, after several generations, through genetic selection, build up an immunity to the insecticide and become resistant. We are thus forced to repeat the sprayings with other insecticides like chlordane, lindane, toxaphene, aldrin, dieldrin, etc., all of which are as effective as DDT but lack its duration of residual effectiveness. Flies become resistant to each of these other insecticides in time, so their use will have to be rotated.

As is obvious, from considering the biology and habits of the housefly, fly control is a community problem, and must be met on a community basis. Part of the difficulty with fly control as now practiced in urban areas is that not all householders or individuals carry out their share of the work; hence, all the neighbors suffer from the shortcomings of one. Central mobile fly-control squads should be organized, equipped with either

individual 5 gallon knapsack or hand sprayers, truck-mounted high-pressure sprayers, or aerosol machines. As pointed out previously, the vicinity of Chicago is well equipped with the equipment and trained crews who could do the work, if the outlying mosquito abatement districts and the pest control or exterminating organizations were called upon to do the work as needed. Plane spraying of 5% DDT can and probably should be resorted to if the problem becomes sufficiently severe.

B. *Epidemic skin parasitoses*: A direct result of the crowding and unsanitary conditions under which refugee and homeless populations will live after an atomic explosion may well be a dramatic explosive outbreak of various skin dermatoses and parasitoses. People will be forced to double up, many living in one room in close proximity to one another, use the same clothing and bedding, and perhaps huddle together for mutual warmth. The lack of sanitary facilities for regular bathing will compound the difficulties.

Primitive and submarginal peoples with inadequate housing live under such conditions now. We, with our at present vaunted higher standards, find it difficult to believe that we would ever sink to that level. But, in the general disorganization following an atomic attack, much of the displaced population will live in as primitive conditions as are found in the slum areas here in Chicago. We do not have to look any further back than London during the years 1941-1943 when, during the period of almost constant air attack by the Germans, the people lived huddled together in the massive subway system. The result was an almost 100% incidence of scabies, up to a 60% or 70% incidence of pediculosis or lousiness, and a very high incidence of ringworm. We should be prepared to deal with all three conditions here in Chicago. They have always been and are the handmaidens of field warfare as well as poverty and depressed conditions throughout the world.

1. *Scabies*. Caused by the minute mite *Sarcoptes scabiei*, which lives intradermally on all parts of the body but par-

15. The foundation of all fly-control programs is proper sanitation. Even with the most thorough application of the best of insecticides, flies will continue to breed, enter an area and do their damage before they are killed by the insecticide. Moreover, it is from the survivors of contact with the insecticides that insecticide-fast strains of flies develop.

ticularly on the fingers, groin, neck, elbows, wrists, ankles and back. The condition is homologous to the mange in dogs, cats, horses, and other animals, caused by other subspecies or varieties of the one causing scabies in men.

The mites live and reproduce in minute tortuous burrows in the skin. They burrow extensively in the epidermal layers and only the gravid or pregnant females come to the surface. Here they are transferred to fresh hosts by contact, either directly or via contaminated clothing or bedding.¹⁶ Upon entering the skin of a new host, the female begins to tunnel and deposits her eggs (about 50 in number) along the walls of the tunnel. The eggs hatch in 3-4 days. The larvae and the two nymphal stages which follow mature rapidly and mate. The whole life cycle is completed in 1 week to 15 days. Population build-up thus, since the mites have no natural enemies, is fantastically rapid. The larvae and nymphs migrate to other parts of the body from the parent burrow and enter hair follicles or penetrate the skin directly, forming vesicles.

The mites carry no disease microorganisms themselves but in the course of their wanderings they set up an intolerable itching which results in an uncontrollable scratching. Thus, besides an exfoliative dermatitis and pruritus with multinodular serous vesicles which can be fairly extensive, caused directly by the mites, secondary staphylococcal and some streptococcal bacterial infections are set up. The latter lead to a frequent septicemia, the former to an extensive erysipematous dermatitis.

Diagnosis is made by examining the skin lesions under a strong hand lens or by taking epidermal scrapings and examining microscopically. The mites are characteristic and when found are pathognomic for the disease. A positive diagnosis of scabies can be made only when the mites are found.

The reservoir of individuals infected with scabies, just like those with lice or ringworm, are always with us, albeit at a low percentage. It takes only one

or a few individuals, however, to start an epidemic under the proper unsanitary and substandard living conditions.

Treatment of scabies now is fairly simple. The material benzyl benzoate is a highly effective miticide and, since *Sarcoptes* is a mite, it is equally effective against this type. Incorporating benzyl benzoate along with a skin analgesic such as benzocaine in either alcohol (for a liquid) or in a salve base make ideal therapeutants. In addition, DDT and the gamma isomer of benzene hexachloride (called "lindane"), both now widely used as insecticides, are also highly effective and may be used in the same types of preparations. Various of the pharmaceutical houses have these ointments commercially available. Treatment consists of a thorough washing of the skin with tincture of green soap and water followed by a widespread application of the scabicide ointment, well worked into the lesions. The materials have sufficient residual effectiveness to kill the larvae of the mites when they hatch from the eggs. Hence only one treatment is usually necessary. A regimen of penicillin or other antibiotics can be given to control the associated bacteremia or staphylococcal infections.

Prophylaxis, however, is more difficult. The clothes of the patient must be thoroughly sterilized by laundering and ironing to prevent reinfection. Since scabies is essentially a social disease, not only must the clothes of the one patient be sterilized (by live steam, boiling water, dry cleaning, or hot ironing), but so also must the clothing of everyone else with which he is in intimate contact, as well as the bedding of all concerned. Remember, the mites are small, tenacious, and easily spread.

2. Pediculosis (lousiness). Many of the same things which were said about the epidemiology of scabies can be said about the epidemiology of pediculosis. There is a small reservoir of infected individuals always among us. When living under crowded conditions and using the same clothing and bedclothing, transfer of infection is easy and the parasite population build-up is rapid. This is especially true when the nutritional state of the

16. Cast-off clothing and bedding of infected persons remains capable of infecting others for at least 11 days.

individual is lowered and the community as a whole has a lowered personal sanitation level.

Two types of lice infect man, pubic lice ("crabs") and the head-body lice complex. The former, *Phthirius pubis*, can be dismissed from the present discussion because it is essentially a venereal disease. In addition, it is not known to serve as a vector of any infective disease. Despite the protestations of many that they contacted their infection from towels or toilet seats, venereal contact is still the principle mode of transmission. However, it is not the only one, and the use of common or piled bath towels in dormitories or gymnasiums, and contact with dropped hairs bearing lice or eggs on clothing, bedding, or the seats of public toilets as a result of scratching by an infested person, should not be overlooked. Although a different segment of the population (i.e. the displaced) may become infested in addition to the groups which are ordinarily infested, still the percentage of infestation is not likely to be raised to a high degree.

The head and body louse are two distinct forms or varieties of *Pediculus humanus* (var. *capitis* and var. *corporis*, respectively). They have different biologies and ecologies but are capable of interbreeding and of adaptation from one type to the other. Their specificity is not as sharp as once thought. The head louse spends its whole life cycle mainly in the hairs of the head, and on occasion in those of the eyebrows, chest and armpits. The eggs or 'nits' are laid singly and glued directly to the hairs. The nymphs which hatch from the eggs in 5-9 days look like and behave just like the adults. They mature in 7-9 days. The whole life cycle is completed in 14 to 18 days. The body louse, on the other hand, is usually found mainly on the body but leaves its host when not feeding and goes wandering off among the clothes. They lay their nits or eggs on and among the seams of the clothing or bedding, and can stay off their host for 48-72 hours at a time without harm and can survive up to 10 days without a blood meal. Epidemiologically, the body louse is the greater danger, not only because it can spread more easily

from person to person, but also because it is a more efficient vector of the various diseases transmitted by lice. Outbreaks of mass lousiness are apt to be more severe in the winter than in the summer, because the population wears heavy clothing which they change infrequently.

Besides the direct and marked effect of the bites themselves (urticaria, intense pruritus, and petechial hemorrhage at the site of the innumerable feeding stab wounds, followed by extensive melanoderma) and the secondary bacterial skin and septicemic infections as a result of the laceration and excoriation produced by incessant scratching, a variety of ill-defined psychic disturbances (insomnia and neurasthenia) result from the attendant loss of sleep, irritation, and restlessness. Even more important, however, is the fact that body lice are capable of transmitting various infections of man; epidemic typhus, trench fever, and epidemic relapsing fever, as well as Brill's disease, and favus and impetigo. A listing of the ravages and epidemics of typhus, trench fever, Brill's Disease and relapsing fever reads like a compendium of every war, famine, depression, and mass migration in which man has ever participated. The course of history has been changed several times by the losses and debilitations of troops due to these diseases. The diseases are world-wide in distribution and may occur wherever human lice, are abundant.

Epidemic typhus, trench fever, and Brill's Disease are all caused by closely related types of rickettsiae (*Rickettsia prowazeki*, *R. wolhynica* (= *pediculi*) and *R. mooseri*). Their debilitating effect on a population or army is immediate, sudden and high continuous fevers, severe headache and marked prostration followed by, on the 4th or 5th day, petechial hemorrhages throughout the mucosa and skin, and widespread skin rashes which are characteristic. The mortality rate varies from 5% to 70% but averages 20%. The drain put on hospital facilities is great. Hospitalization is prolonged, and constant, adequate, careful nursing care is imperative. Aureomycin, chloramphenicol (=chloromycetin) and terramycin are all effective as therapeutants.

However, prophylactic measures are by far the recommended procedure in the control of these diseases. Effective vaccines are available only against epidemic typhus.

Relapsing fever, caused by the spirochaete, *Borrelia recurrentis* is every bit as debilitating as the typhuses. It is characterized by a high fever, reaching 104-105° F and lasting 3-4 days, followed by an afebrile period of 3-10 days, and a succeeding febrile attack of 3-4 days. There may be 3 to 10 such febrile attacks which are characteristic of this disease. The spirochete is easily found in the blood after Giemsa staining of thin or thick slide films during the febrile periods. There is no vaccine available because the antigenic types of the organism are too varied. Any of the old stand-by intravenous arsenicals such as neoarsphenamine or the antibiotic, penicillin, can be used effectively in treatment. None of the other commonly-used antibiotics have as yet been proven of value clinically.

Control of lousiness among civilian populations or troops is relatively easy. Ten percent DDT powder (i.e., DDT diluted with talc) is blown into the hair, over the whole body, and beneath and onto the clothing in a systematic fashion with any type of hand duster. Equipment is available for the mass delousing of populations so that 1000 or more individuals can be dusted in 1 hour with one apparatus. The insecticide is highly effective against the lice and retains its effectiveness for a sufficient time to kill the nymphs as they emerge from the eggs. The clothing which is not being worn and the bedding should also be treated either by dusting with DDT or by dipping into a DDT solution or emulsion and then drying. The latter is to be preferred because by impregnating the clothing with 2% DDT solution, the clothes will remain lethal to lice for a period of several months.

3. Dermatophytoses (Ringworm and Favus), and Impetigo Contagiosa. A variety of superficial skin and hair mycoses masquerade under the names of ringworm, favus, tinea, and athlete's foot. The fungi, belonging to the genera *Tri-*

chophyton, *Epidermophyton*, *Microsporium*, etc., are easily disseminated by direct contact and through the intermediary of clothing, bedding, and toilet articles, like the parasitoses described above. They spread with lightning rapidity, and, for the most part are highly resistant to treatment. On the infected individual they are highly annoying and pruritic. Secondary staphylococcal skin infections are frequent concomitant contaminations.

The fungi, all of which are closely related, invade only the superficial keratinized areas of the body, the skin, hair, and nails. They do not cause systemic infections and do not invade the subcutaneous tissues. However, the infections may be acute as well as subacute and chronic. The specific symptomatology varies with the type of infection and may or may not be associated with acute inflammatory reactions, hyperkeratosis, interstitial edema, and secondary bacterial infections, or a heightened skin sensitivity with allergy-like reactions. The associated pruritus is intense and the disfigurement more or less severe depending on the type of infection.

The detailed epidemiology of each of the dermatophytoses varies with their specific nature. Those which are animal (i.e. cat or dog) borne can be dismissed as being an added problem. However, ringworm of the scalp (tinea capitis) in children is apt to be very severe. Transmission from person to person is by hairs infected with the fungus. Since the fungus itself causes the hairs to break off a short distance from the scalp, the infected hairs are easily dislodged from the scalp. They may be picked up almost anywhere, from the clippers in barber-shops, the backs of theater seats, railroad coach seats, by direct contact during play, etc. Athlete's foot (tinea pedis) is apt to increase, although a high proportion of the population is already infected, through the use of common showers and bathrooms among the displaced. Foot disinfection baths are ineffective. Since the spores of the fungus are on the floors, furniture and almost everywhere, resistance to infection depends more on personal foot hygiene than on any other sanitation measure. Not much can be said

about the possibility of increase in the other tinea (glabrosa of the skin and barbae of the beard). They are less liable to assume epidemic proportions than the others but might well increase significantly in numbers.

Prophylactic, i.e., preventive, measures to control the infections are, in general terms, quarantine of the infected, reporting of all cases, eliminating the use of common toilet articles, sanitary control of barbershops, education of the public to initiate proper skin, clothing, and shoe hygiene, and the prompt institution of therapeutic measures.

The control of an epidemic of ringworm of the scalp is a complex procedure, and must be undertaken as a public health program by the community rather than the individual. It includes determination of the infected individuals by fluorescent examination under ultra-violet lamp, the continuous wearing of sterilizable stocking caps, manual or X-ray epilation of all infected hairs at frequent intervals, daily hair shampoos, and the application of topical remedies (copper undecylenate or salicylanilide ointments or the new antibiotic prodigiosin). The program is a long term one and may require 6 months or more of constant attention.

Impetigo contagiosa, on the other hand, is a purulent superficial dermatitis caused by a combination of staphylococcal and streptococcal bacteria. It may occur in epidemic proportions. Like the others, however, it is transmitted by direct contact, either from the moist discharges of the skin lesions or from contact with articles recently soiled by these discharges. The infection is rapidly inoculated from place to place on the patient's body by scratching.

A regimen of personal cleanliness, particularly to the avoidance of common use of toilet articles, prompt treatment of the infection with antibiotics, and eradication of parasitic infections of the skin are important individual measures. In addition, however, proper public health measures must be enforced, reporting of epidemic prevalence, isolation of cases, and disinfection of towels and other utensils, disposal of dressings, etc.

C. *Rats and Rat-Borne Diseases:* Of

more probable importance than the insects as a vermin problem here in Chicago will be the rats and rat-borne diseases. The severe structural damage and attendant debris will produce ideal breeding places and harborage for rats—these in addition to the abnormally high number that are now present.

Rats, of course, are the important reservoirs of murine typhus, plague, salmonellosis, dysenteries, and fully seventeen other types of viral, rickettsial, and bacterial infections of man, as e.g. Weil's Disease or hemorrhagic jaundice, rat-bite fever (Sodoku), trichinosis, etc. Only the first three named need concern us at the present. We will neglect entirely the extensive depredations to foodstuffs and structures caused by rats, estimated at \$200 per rat per year on farms in this country, as well as their role in biting sleeping children.

For a proper understanding of the problem, we must take into account some of the habits of the commensal or domestic rats of man here in this area. The rat involved is almost entirely *Rattus norvegicus*, the Norway or Brown rat.

The rats nest under accumulated debris, in between walls and lathes, in any type of hollow or enclosed space, and under packing crates, etc.; in short, wherever security can be found within reasonable distance of food and water. Hence the possibilities of harborage are almost endless. They are capable of digging burrows in the ground, usually under foundations, and run along definite runways between their feeding areas and their nesting sites. They have completely omnivorous tastes, and will eat any kind of food consumed by man, meats, fish, fruits, fresh or dried vegetables, bread, flours, or any types of stored products and, of course, garbage. Their litters are large (up to 12-14) and they reach sexual maturity quickly (6-7 weeks); the gestation period averages only 25 days; litters are spaced at 60-day intervals; and there may be 5-7 litters a year. Hence, their population build-up is rapid. They are agile climbers and can climb up a wall or cross a thin wire; they are strong diggers and can dig under walls; and they are powerful gnawers, being able to work their way through

wood crates, walls, and doors, lead pipes, and occasionally concrete. Their incisor teeth grow from 4 to 6 inches a year. They are extremely stealthy and wary, and venture forth mainly in the dark. They do, occasionally, come into the light but then it is only to run across an area, not to feed.

The Brown rat is host to a variety of rat fleas, about 30 species here in the U.S.A., only five of which are common. The most important of these are *Xenopsylla cheopsis*, the oriental rat flea, and *Neopsyllus fasciatus*, the northern rat flea. These fleas live as adults as ectoparasites on the rats, sucking their blood. However, they lay their eggs, and their larvae live and develop in the rats' nest. The rat fleas find man as ready and acceptable a host as the rat and, in the absence of rats, will readily attack man. This is the basis for the primary transmission of murine typhus and plague. Salmonellosis and Weil's disease transmission is tied in with the proximity with which the rats live with man's food and water supply.

The rats themselves are the natural reservoirs of these various diseases. They transmit them either directly or indirectly. The cycle of murine typhus is rat to man via the bites of the rat flea, and between the rats themselves via either rat lice or rat fleas; the cycle of plague is from either the domestic rat or wild rodent to domestic rat by wild rodent or rat fleas, and to man from the domestic rat via the rat flea, then from man to man pneumonically; in salmonellosis it is from rat to man via man's food contaminated with rat excreta; in Weil's disease from rat to man via water contaminated with rat urine.

Keep in mind this one fact—rats are your closest neighbors in much of this

city, closer than your next-door human neighbors, and, in addition, they have first call on your food supplies while they are still stored in the warehouses or grocers' shelves.

Although we will not discuss the bacteriology, symptomatology, pathology, diagnosis, treatment¹⁷ or detailed epidemiology of these infections, the diseases, especially plague, are, nevertheless, important, and have been highly important in history.¹⁸ The importance and high incidence of murine typhus, especially in the Southern United States, has only recently been appreciated, with the differential diagnosis of this disease from spotted fever, epidemic typhus, Brill's Disease and a variety of other pyretic petechial infections. Plague is caused by the bacterium *Pasteurella pestis*, murine typhus by the rickettsia, *Rickettsia typhi* (formerly *R. prowazeki* var. *mooseri*), Weil's disease by the spirochete, *Leptospira icterohemorrhagiae*, and salmonellosis by the gram-negative rod, *Salmonella enteritidis*. This last is a typical food infection characterized by diarrhea, abdominal cramps, fever, nausea and vomiting.

The incidences of these various diseases depends upon the presence of reservoirs; that is, infected rats, their flea populations, and the populations of rats themselves.

Chicago has a rat population which probably exceeds its human population by several fold. Not only does Chicago have the largest rat population in number of any city in the U.S.A., but the population density is as high as anywhere. Only the rats' own population pressure keeps it from exceeding what it is now. Certainly neither the rodent control program, the building structural

17. Notable advances have been made in treatment of these various infections in recent years. A combination of streptomycin and sulfadiazine easily controls plague and, if given early enough and in adequate doses, is capable of curing even pneumonic plague. Murine typhus, like the other rickettsial infections, can be controlled by aureomycin, chloramphenicol (=chloromycetin) and terramycin. Weil's disease can be controlled by penicillin or intravenous arsenicals. Salmonellosis, however, is a different matter. None of the currently used antibiotics are particularly efficacious, although neomycin appears to be the best.

18. Plague, on a world-wide basis, has always been mankind's worst enemy. Its history is long and well recorded by numerous chroniclers from antiquity to the

present. Homer described plague among the Greeks besieging Troy in 1184 B. C. The Great Plague of Justinian in the Sixth Century is reported to have killed half the population of the Roman Empire and its build-up probably played an important role in the final disorganization of that empire after the "Fall of Rome." During the early Middle Ages, the Fourteenth Century, 25 to 40 per cent of the population of all Europe and England was decimated by plague. Called the "Black Death" it killed some 25 million people and set Western Civilization back several centuries. The course of history has been changed several times due to the ravages of this disease on different armies. The present pandemic, which began in the Orient in 1894, is the most widespread of all. It has invaded every continent and nearly every country. In India alone 12 million deaths have occurred in the past 55 years.

codes, nor the garbage disposal system is of much aid in keeping it down. In fact, it is the lack of these programs which encourages the rats here. The city's alleys constitute one giant garbage dump which supplies plentiful food; the decrepit and poorly-constructed buildings offer abundant harborage; and the lack of any coordinated community control program lets the population remain at a high level. While the stock yards might serve as a great focal point from which the rats can disseminate, under present conditions much of the socially and economically blighted and depressed areas of the city serves as reservoirs of this dissemination.

The main factor which has prevented outbreaks of plague here in Chicago is the lack of infected rats, while outbreaks of murine typhus have possibly been absent because of the low population of rat fleas on the rats.^{19, 20} Salmonellosis and Weil's disease are with us here in the city, at a rate probably far above its reported or even suspected levels. (From 3 to 52% of the rats in Chicago have been found infected with *Leptospira icterohemorrhagiae*.)

Rat control is a complex battle and a never-ending one. It involves first structural modifications in buildings, homes, and warehouses to build out the rats; that is, to rat-proof (isolate) structurally by metal sheeting or barriers, wire guards, deep foundations, closing or guarding of all openings, etc., so that the rats cannot gain entrance into buildings for either breeding or depredation. Then comes cleanliness, to starve the rats out. Proper garbage containers tightly closed

and an efficient city garbage collection system up to and including the final refuse disposal at the garbage dumps are primary requisites in decreasing the rat population by starvation. Proper storage and warehousing methods and good housekeeping in markets, meat plants, commissaries, and food stores and warehouses are also important. Rat eradication programs by trapping and using the newer rodenticides, ANTU, 1080, WAR-FARIN, etc., mixed with food or water in baits and placed in easy accessibility to the rats, can, if properly carried out, kill off large numbers of rats. These palliatives, however, will not eradicate the rats and their populations will build up again. In this latter program it is essential to carry out concomitantly a DDT-dusting program along the runways and into the burrows and nests of the rats to kill their flea ectoparasites. If not, upon the death of the rats, the fleas will attack man as their only other source of food and the danger of disease transmission is thereby increased. Finally, stringent and adequately and honestly enforced legal regulations in the building and sanitation codes pertaining to rat-proof construction in old and new buildings, maintenance of garbage in inaccessible containers and its collection and disposal, and regular sanitary inspection of all food and drink processing plants, restaurants, warehouses and stores round out an adequate but far from complete rat control program.

The rat problem here in Chicago is so severe that an adequate control or eradication program can not be carried out

19. A general abundance in any given locality of at least one oriental rat flea (*Xenopsylla cheopis*) per rat usually is regarded as the minimum required to support plague among domestic rats, and hence serve as a source of infecting humans. The rate here in Chicago varies but is frequently much higher than that. Although in the United States no plague outbreaks due to bites of fleas have occurred where the average midwinter (i.e. January) temperature is lower than 45° F (it is 25° F in Chicago), or where the mean relative humidity at noon in July is less than 60 per cent (it is between 55 and 60 per cent here in Chicago), this is not an inviolable rule governing the distribution of the disease. Numerous areas in the world, including the pandemic focus in Manchuria, have and have had the disease endemically, where their mean midwinter temperatures and mean summer relative humidities are lower than those given as the rule here in the U.S.A.

The U. S. has a tremendous endemic reservoir of plague infection in its wild rodent population. Infected wild rats, ground squirrels, gophers, voles, meadow-mice, etc., have been found as far east as Kansas

(1945-1946) and North Dakota, and appear to be continually spreading eastward from their original focus in California. This infection in wild rodents is a constant potential source for the infection of domestic rodents in urban communities located in the vicinity of rural plague foci. Murine typhus fever is a common infection among domestic rats of the Southern U.S. Its rate approaches 100 per cent of the rat population in some urban business districts and in many rural counties, over 50 per cent of the rats caught yielded positive murine typhus complement fixation tests. In areas where the rat infection ranged from 40 to 60 per cent, 4 per cent of the human population of the areas showed positive tests.

20. The danger of a plague or murine typhus outbreak in Chicago is real, not so much from the effects of an A-bomb disaster per se, but from the possibility that, in bacteriological warfare, infected fleas will be dropped from planes and thus infect the rodent population here. This was done in Manchuria during the Sino-Japanese war.

after an A-bomb explosion. It is one thing which should be started, organized, and gotten well underway *beforehand*. The Civilian Defense Group here in Chicago considered the present rat problem sufficiently serious that it has strongly recommended that such a control problem be initiated now as a prophylactic measure. However, until the Bureau of Sanitation revises its garbage-collection procedures and procures additional equipment and until the City code is modified to provide enforcement of regulations ensuring that householders cooperate by not throwing garbage in the alleys, not much progress will be made.

D. Other Household and Stored Products Insects: It is difficult to see how an atomic disaster will alter the problem of the other household insects of medical and sanitary importance, i.e., bedbugs, cockroaches, dog and cat fleas, firebrats, etc., or increase their role as a public problem. Hence these can be neglected.

E. Mosquitoes: In the city itself, i.e., in the built up areas, there are no anopheline mosquitoes, and pest mosquitoes are a minor problem. The attack will, presumably, be directed against just such areas, if it comes. In the event of an atomic bomb attack in the spring or summer: it is probable that *Culex pipiens*, and several species of *Aedes* will breed in the temporary water pools among the rubble. These are apt to be of a minor menace and can be dismissed. Control of these mosquitoes could, if necessary, be carried out at the same time and with the same equipment and materials as will be used in fly control. The problem of dengue fever can not be completely dismissed but will be discussed under bacterial warfare, as will the use of insects, such as fleas and mosquitoes, etc., to spread other diseases.

4. COMMUNICABLE DISEASES

The various air-borne respiratory and food-borne intestinal, venereal, parasitic, and contact communicable disease infections which have to be considered with relation to their epidemiological aspects following an atom-bomb disaster are no different than those which are found normally in the population.

The major differences are apt to be

found in the higher incidence, greater rapidity of spread and probably increased virulence. These will be due to the crowding of populations, lower sanitation, housing, and clothing standards, and a lower nutrition level. To some extent, the incidence of some of the diseases will depend upon the season of the year when the attack takes place. It is probable that the duration of the epidemic season will be longer on both ends, beginning earlier than normal and extending later than usual.

Which diseases will strike the hardest or be most important is difficult to say. There is no assurance that relative incidence will be the same as occurs normally in this area, but there is little reason to believe that it will be different.

Thus, it is possible to take the list of communicable diseases as prepared by the American Public Health Association and pick out those which are apt to be important. They are here listed alphabetically. Those which are of importance in bacterial warfare, whether listed or not, are discussed in more detail under that heading. Those which have already been discussed and the venereal diseases are omitted. (See accompanying chart.)

5. MILK AND FOOD POISONING

The danger of mass outbreak of milk and food poisoning will be greatly intensified after an atomic attack: due to the disruption of public utilities, of pasteurization plants, of the normal channels of food distribution, and the fact that mass feeding of large numbers of evacuees must be resorted to. The impossibility of checking all food handlers under emergency conditions, inadequate equipment and the inability of properly sterilizing eating utensils, and general lowered sanitary level of evacuee camps will all tend to contribute to such outbreaks.

A wide variety of bacteria and some protozoa are capable of causing the various enteric fevers and gastro-enteritis of food poisoning. Numerous species of *Staphylococcus*, *Shigella*, *Salmonella*, *Clostridium*, and *Endamoeba*, to mention only a few genera, are capable of causing such food poisonings.

Menus at the feeding centers should not include items that are notorious vehicles

Disease	Causative Type of Organism	Method of Transmission
amebiasis	Protozoa	ingestive
ascariasis	helminth worm	ingestive
bacillary dysentery	shigella bacillus	ingestive
chicken pox	virus of varicella	direct contact
common cold	virus (one or more)	respiratory
diarrhea of the newborn	unknown	unknown,—ingestive?
diphtheria	Corynebacterium bacillus	respiratory
enterobiasis	pinworm, helminth worm	ingestive
food poisonings	staphylococcus	ingestive
hemolytic streptococcal infections:		
scarlet fever & streptococcal		
sore throat	alpha hemolytic streptococci	respiratory
erysipelas	alpha hemolytic streptococci	contact
puerperal infection	beta hemolytic streptococci	contact
infectious encephalitis	viruses, various	arthropod borne & unknown
infectious hepatitis	virus(es)	unknown; blood transfusions; ingestive?
infectious mononucleosis	unknown	respiratory
influenza	viruses	respiratory
leptospirosis	spirochete	skin contact
lymphocytic choriomeningitis	virus	ingestive, arthropod-borne? respiratory?
measles	virus	respiratory (droplet)
meningococcus meningitis	Neisseria coccus	respiratory
mumps	virus	respiratory (droplet)
paratyphoid fever	Salmonella paratyphi	ingestive
pertussis (whooping cough)	Hemophilus bacillus	respiratory
pneumonias		
pneumococcal	pneumococcus	respiratory
bacterial	various oral bacteria,—streptococcus & staphylococcus	respiratory
virus (primary atypical)	virus	respiratory
poliomyelitis		
(infantile paralysis)	virus	respiratory
rheumatic fever	unknown (streptococci?)	respiratory?
rubella (German measles)	virus	respiratory
smallpox (variola)	virus	respiratory
tuberculosis		
pulmonary	Mycobacterium bacillus	respiratory
other than pulmonary	Mycobacterium bacillus	contact
typhoid fever	Salmonella typhosa	ingestive

COMMUNICABLE DISEASES (American Public Health Ass'n.)

of food-borne diseases, e.g., cream- or custard-filled pastries, warmed-over poultry dressing and gravy, etc. Thorough cooking of all foodstuffs is the basic safeguard against food poisoning. This must be followed by rapid serving and as little manual handling of the foodstuffs as possible. Perishable foods must be properly stored. An adequate sanitary inspection system must be maintained to insure that spoiled or damaged foods are not consumed but are properly destroyed. Camp and mess-hall sanitation standards must be maintained as high as possible.

Outside the camps, the householders of unaffected areas must be warned of the

breakdown of normal control services and told to boil all milk which has not been pasteurized, and to be on the lookout for spoiled products, including meats and canned goods.

The city's Department of Public Sanitation must and is taking measures to isolate the foodstuffs from the damaged area and will release that which is safe; will reroute milk supplies from damaged pasteurization plants to undamaged ones; and will inspect and provide inspection stickers for trucks hauling approved foods.

There are many other aspects of Public Health problems involved in an atomic

attack which can only be mentioned, e.g., blood typing of all individuals (the type plus an identification number will probably be tattooed onto the body under the armpits); vaccination of the population against tetanus, diphtheria, small pox, and typhoid, to immunize them against these infections; adequate shelter; and maintenance of nutrition standards.

(Part II. "Bacterial Warfare," will appear in a future issue.)

SELECTED BIBLIOGRAPHY OF MOST RECENT WORKS

1. Effects of Atomic-Bomb Attack
 - a. "The Effects of Atomic Weapons" Combat Forces Press, Washington, D.C. (also McGraw-Hill Book Co., N.Y.C.) 456 pp. 1950.
 - b. Behrens, C. W. Editor): "Atomic Medicine" Thomas Nelson & Sons, N.Y.C. 416 pp. 1949.
 - c. "What You Should Know About the Atomic Bomb," Surgeon General, Army Medical Dept., Washington, D.C. 55 pp. 1950.
2. Organization of Civilian Defense, with Special Reference to Chicago
 - a. "United States Civil Defense" N.S.R.B. Document 128 National Security Resources Board, Executive Office of the President, Washington, D.C., 162 pp. Gov't Printing Office, October, 1950.
 - b. "Health Services and Special Weapons Defense" Federal Civil Defense Administration, Executive Office of the President, Washington, D.C., AG-11-1, 260 pp., December, 1950. Gov't Printing Office.
 - c. "Chicago Alerts: A City Plans its Civil Defense Against Atomic Attack" Chicago Civil Defense Corps, Chicago, Ill., 266 pp., Jan., 1951.
 - d. "Civil Defense for National Security" Office of Civil Defense Planning, National Military Establishment, Washington, D.C., Gov't Printing Office, 301 pp., Nov., 1948.
 - e. Bulletin of The Atomic Scientists, Vol. 6; Nos. 8-9; Aug.-Sept. 1950, Chicago, Ill. Special Issue on "Civil Defense Against Atomic Attack."
3. Water, Sewage, Milk, and Food
 - a. "Chicago Alerts," Chicago Civil Defense Corps, Chicago, Ill. 266 pp., Jan., 1951.
4. Insect and Rodent Problems
 - General:
 - a. Matheson, R.: "Medical Entomology" 2nd Edit., Comstock Publishing Co., Ithaca, N.Y., 612 pp. 1950.
 - b. Herms, W. B.: "Medical Entomology" 4th Edit., Macmillan Co., N.Y., 643 pp. 1950.
 - Flies:
 - c. Hall, D. G.: "The Blowflies of North America." Thomas Say Foundation, Lafayette, Ind., 477 pp. 1948.
 - d. James, M. T.: "The Flies that Cause Myiasis in Man" U.S. Dept. Agric., Misc. Public. No. 631; Sept. 1947, 175 pp.
 - e. Coffey, J. A. and Schoof, H. F.: "The Control of Domestic Flies" Communicable Disease Center, U.S. Public Health Service, Atlanta, Ga., 73 pp. 1949.
 - Scabies:
 - f. Friedman, R.: "Biology of Acarus scabiei" Froben Press, N.Y.C., 183 pp., 1942.
 - g. Friedman, R.: "Scabies,—Civil and Military" Froben Press, N.Y.C., 288 pp. 1941.
 - Lice:
 - h. Grinnell, M. E. and Hawes, I. L.: "Bibliography on Lice and Man" Bibliographical Bulletin No. 1; U.S. Dept. of Agriculture, Washington, D.C., 106 pp., 1943.
 - i. Buxton, P. A.: "The Louse" 2nd Edit., Edward Arnold & Co., London, 164 pp. 1947.
 - j. "DDT and Other Insecticides and Repellents Developed for the Armed Forces" Misc. Public. No. 606, U.S. Dept. of Agric., Washington, D.C., 71 pp. 1946.
 - Dermatophytoses:
 - k. Conant, N. F., Martin, D. S., Smith, D. T., Baker, R. D., and Callaway, J. L.: "Manual of Clinical Mycology" W. B. Saunders & Co., Phila., 348 pp. 1944.
 - l. Lewis, G. M. and Hopper, M. E.: "An Introduction to Medical Mycology" Year Book Publishers, Inc., Chicago, Ill., 3rd Edit., 366 pp. 1948.
 - Rats and Rodent-Borne Diseases:
 - m. Hull, T. G. (Editor): "Diseases Transmitted from Animals to Man" Charles C. Thomas, Publisher, 3rd Edit., 571 pp. 1947.
 - n. "Rat-Borne Disease. Prevention and Control" Communicable Disease Center, U.S. Public Health Service, Atlanta, Ga., 292 pp. 1949.
 - o. C.D.C. Bulletin; Vol. IX; No. 8; Aug. 1950, Atlanta, Ga. Series of 5 articles on Rat-Borne Diseases, 1950
 - p. Elishevitz, H.: "Epidemic Control with DDT, ANTU, and 1080" (in 2 parts) Soap & Sanitary Chemicals, Vol. 23, Nos. 5 and 6, May & June, 1947.
5. Communicable Diseases
 - "The Control of Communicable Diseases in Man" American Public Health Association, New York, 19 N.Y., 7th Edit., 159 pp. (Also, Reprint No. 1697, from Public Health Reports; U.S. Public Health Service, Washington, D.C.) 1950.

A MATHEMATICAL APPROACH TO MICROSCOPIC ANATOMY*

(Preliminary Notes)

HANS ELIAS, Ph.D.**

Introduction

The method of morphology consists of the observations of shapes and subsequent verbal description. As Korzybski has shown, language has a structure different from that of space. In morphology we are dealing with space. Consequently, language is inadequate to describe the objects of any morphological science.

In the field of microscopic anatomy we are confronted with the additional handicap that the objects studied cannot be handled and viewed from all sides. To be seen they must be teased into little bits and thus be distorted; or they must be cut into thin slices which represent only infinitesimal, 2-dimensional sections of a 3-dimensional organ. To draw correct conclusions concerning the structure of an organ from a microtome section has been extremely difficult. And the result has often been disastrously fallacious.

In recent years (Elias 1945, 1948, 1949; Kornhauser 1948; Bengelsdorf and Elias, 1950; Elias and Bengelsdorf, 1951) a few perpetuated fallacies in the field of microscopic anatomy have been detected as such and corrected. The method employed was mere common sense. Geometrical and statistical considerations were applied to a very limited degree.

The following results were obtained:

(1) The glands in the mucosa of the proventriculus (glandular stomach) of birds had consistently been described as simple tubular glands. The fact that one sees in sections only apparently longitudinal sections of the alleged tubules, but never any transverse or oblique sections, leads to the conclusion that these must be sulciform (slit-like) glands. This opinion was confirmed by the study of surface structure and by three-dimensional reconstruction (Elias 1945).

(2) The zona arcuata (=glomerulosa)

of the adrenal cortex of the horse was said to consist of arches and cords of cells. It was shown by application of the same methods that these formations are dome-shaped and flat sheets or plates of cells (Elias 1948). The so-called zona fasciculata of the horse was shown not to consist of cell cords, but to be a continuous mass of cells tunneled by parallel, cylindrical sinusoids (ibid.).

(3) Kornhauser (1948) demonstrated that the so-called stereocilia of the epididymis are flat walls which are resting upon the intercellular terminal bars on top of the epithelium, resembling all together a honeycomb.

(4) In 1949, the writer showed that the mammalian liver does not consist of cell cords as had been maintained since 1859 (Gerlach), but that it is constructed of walls or plates which are uniformly one cell thick and all connected with one another.

(5) Most recently it was found (Bengelsdorf and Elias 1950; Elias and Bengelsdorf 1951) that the liver of lower vertebrates which was said to be a netlike, tubular gland, is in reality a continuous mass of cells, tunneled by the network of lacunae (labyrinthus hepatis) in which the sinusoids are suspended. The parenchymal portions (walls, plates) between the lacunae are predominantly two, but occasionally only one cell thick. The papers referred to in the above paragraphs contain the bibliography of the previous observations which lead to fallacious conclusions.

The Common Sense Method

The method employed in the above studies was little better than common sense. The most characteristic case will be sketched in the following paragraphs.

Previous authors have stated that the liver of lower vertebrate animals is a netlike, tubular gland. The most recent statements of this error were made by Krause (1923). From the old, verbal descriptions the stereogram figure 1 was

* Presented at the 64th annual meeting of the American Association of Anatomists, at Detroit, Michigan, 1951.

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reconstructed. The stereogram shows, at the cut surfaces, the approximate appearance of sections through an organ that would be constructed as the authors had verbally stated. Oblique and transverse sections should dominate the microscopic picture; a few longitudinal sections of rather limited extension should also be seen. However, these authors had published illustrations such as figure 3, presenting an entirely different appearance. A discrepancy between the words and the illustrations was detected. Original observations made by means of photomicrography confirmed the correctness of the historical illustrations and thus showed that the verbal descriptions must be incorrect. The older authors had interpreted slides such as figure 3 as a multitude of longitudinal sections of tubular glands. To demonstrate the meager chances of obtaining almost exclusively longitudinal sections, figure 4 was drawn, and it was seen that the chances of obtaining one perfectly longitudinal section of a single straight tubular gland were extremely small. The chance of obtaining a longitudinal section of one closed mesh of tubules was demonstrated in figure 5: if the improbable has happened that one of the sides of the mesh has been cut longitudinally, the chances that its other 5 sides are cut longitudinally also are again almost zero. If one remembers that the imaginary liver tubules are said to be crooked, it appears to be almost a miracle to obtain a complete longitudinal section even of one closed mesh of tubules only. However, in the historical pictures and in actual slides, one finds numerous, connected, closed meshes of cell rows. From these considerations the conclusion was drawn that the liver of the lower vertebrates cannot be a tubular gland.

If it was not a tubular gland, what was it then? By sheer imagination it was postulated that it may be a continuous mass of cells tunneled by more or less cylindrical spaces. It may be pointed out that it was neither logic, nor any clearly definable scientific procedure which led to this assumption. However, after the hypothesis was conceived, it was tested and found correct. Again, a model was

created, and this time its sections were found to be in conformity with the microslides (figure 2). Furthermore, models were prepared by means of the conventional waxplate method; and very thick, unstained sections which permit the examination of several layers of tissue by focussing up and down were studied. Thus, the hypothesis was confirmed, its correctness verified.

The method of three-dimensional interpretation of two-dimensional sections which we have called "the common sense method" is not satisfactory, in spite of satisfactory results obtained in several cases. It is not very pleasant to depend on imagination and intuition for the invention of a hypothesis which must subsequently be tested. Should there not be a direct method by means of which the three-dimensional quality of an organ or tissue can be detected from single sections?

Some Simple, Geometrical Rules of Sectioning

To develop a satisfactory method of evaluating single microtome sections geometri-cally-statistically is not a simple task. Studies which are expected to lead to concrete results are now under way in this laboratory.

However, certain laws exist which permit even now the evaluation of many types of sections. These laws which are familiar to every amateur mathematician are, however, seldom taken into consideration by histologists, and a re-statement of these laws seems to be in order.

The problem of microtome sections is one pertaining to the geometry of our three-dimensional space. The following simple rules are valid in this space and illustrated in figure 10.

An object located in a three-dimensional space may have:

1. no dimension (a point)
2. one dimension (a line, straight or curved)
3. two dimensions (a surface, plane or curved)
4. three dimensions (a solid i.e. a portion of the three-dimensional space itself).

If a plane is laid through the three dimensional space and several zero, one,

two, and three-dimensional objects are suspended in the space, the plane may section or by-pass any one of these objects. If it sections one of these objects, certain laws govern the character of its section.

1. If the object does not fall entirely into the plane of sectioning, the section will be a figure which has one dimension less than the object. That means that a) the point will not be sectioned at all, b) sections of lines will be points, c) sections of surfaces will be lines, d) sections of solids will be two dimensional, plane areas.

aa) a straight line (=curve of the first order) will be sectioned only once.

bb) a curve of the second order (circle, ellipse, parabola, hyperbola) can be sectioned twice. In other words, they may be presented as two points in the plane of sectioning. In the case of a parabola, a plane parallel to the axis, and in the case of a hyperbola, a plane parallel to an asymptote will cut it only once.

cc) a curve of the n th order (representable by a function which contains a variable of the n th power) may be cut as many as n times.

dd) when two or more of the points of sectioning of a curve fall together, the cutting plane is said to be tangential to the curve.

ee) the section of a plane is a straight line.

ff) the section of a curved surface will generally be a curved line (with the exception of special cutting directions of cylinders, cones and hyperbolas).

All these laws are true, if pronounced in reverse, considering every little grammatical detail of the above statements, as well as the stated exceptions. The reversibility of these statements is important because it allows us to draw, from the microtome sections, certain conclusions concerning the structure which was cut. All structures encountered in histology are solids; but in many cases their thickness is negligible. This is particularly true of structures the thickness of which lies in the vicinity of the resolving limit of the microscope, i.e. in the vicinity of

1 micron or below. Many fibers, membranes and granules, both within cells and extracellular, belong to these thin structures, the width of the sections of which cannot be measured accurately. For structures of such thinness, the following criteria can be applied:

1. If the structure appears in the section as a dot, it is

a) a section of a fiber or thread, if it remains visible when focussing up and down.

b) a granule if it disappears from sight upon focussing up and down.

2. If the structure appears as a line, it may be

a) a fiber if the improbable has happened that it lies entirely in the section. But it is much more probable that it is

b) a section of a membrane.

3. If the structure fills an area, it may be

a) a membrane lying entirely in the section (most improbable). But it is much more likely that it is

b) a section of a solid.

Figures 6-9 show the applicability of some of the enumerated principles. Figure 6 shows two tracts of fibrous tissue in a cirrhotic liver. The upper tract shows a sharp bend. In the lower right hand part of the figure one sees another, straight and more tenuous, fibrous tract. According to our geometrical theory, it is most probable that the upper tract is a section of an inherently plane sheet which has undergone a sharp bend. The left part of the upper tract is in one line with the lower, right hand tract. One is therefore inclined to assume that the bend in the upper membrane is produced by traction exerted by the membrane sectioned at the lower right. Yet, no connection between both tracts is seen in the section figure 6. It must, therefore, be assumed that the membrane shown at the lower right is connected above and below the plane of sectioning with the sheet seen above. In addition, the upper tract comes to an abrupt end not far from the upper right hand corner of the figure. From this analysis we can conclude that figure 6 is the section of two plane, fibrous sheets or membranes which are connected along an edge, running ap-

proximately vertically to the cutting plane through the bend in the upper tract, that one margin of the upper membrane runs at an angle to the plane of sectioning, and through the right end of the upper "tract." We can further conclude that the tenuous sheet at the lower right has a rather large hole, but that the margins of this hole are so constructed that the tractional qualities of the sheet as a whole are not impaired. These theoretically arrived at conclusions from a single section were confirmed by reconstruction of the membranes from serial sections, shown in figure 8.

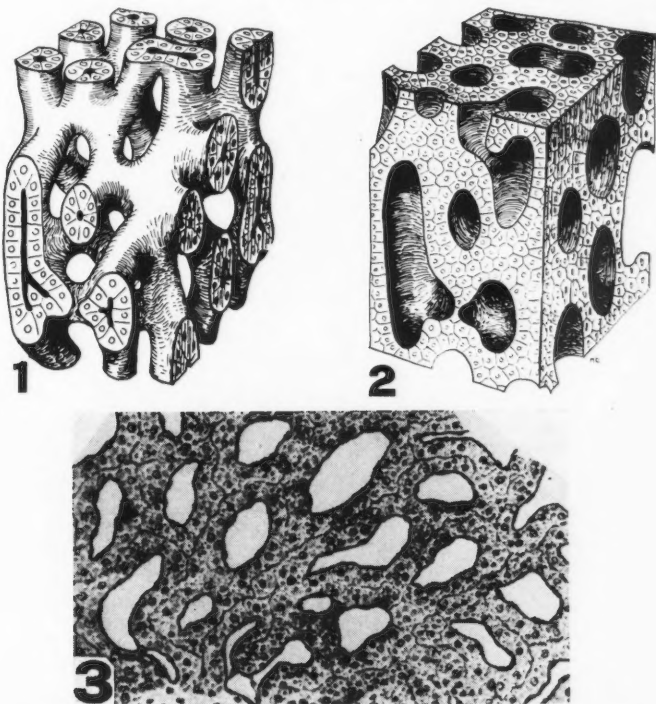
Another and quite different example is shown in figures 7 and 9. This pair of images is from the same cirrhotic liver as figures 6 and 8. Grossly seen, figure 7 shows a curved tract of connective tissue. It is reasonable to assume that it is probably the section of a curved, fibrous sheet, as confirmed by the reconstruction shown in figure 9. At closer

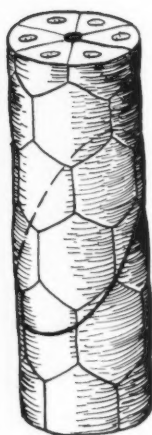
examination of figure 7 one sees that the curved sheet is composed of threads. The longest of these sectioned threads, when measured with the micrometer appears to be 40 microns long. However, at higher magnification it is seen that one end of each can be focussed high, the other one low. Since the thickness of the section is known to be 10 microns, the slant of the membrane in regard to the plane of sectioning can be calculated, as shown in figure 11 to be $\text{arc tang } \frac{1}{4} = 14^\circ$ approximately.

These two examples may suffice to illustrate the usefulness of applying principles of three dimensional geometry to the study of histological sections.

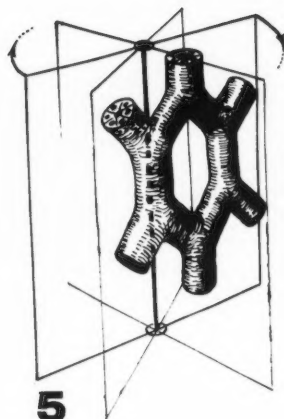
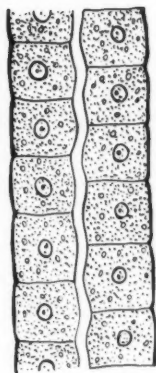
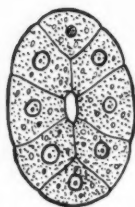
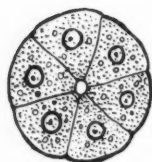
The evaluation of the shapes and of the arrangement of solids, i.e. of structures the thickness of which is far above the resolving limit of the microscope, requires the employment of more complicated methods which will be the object of a subsequent note.

ILLUSTRATIONS

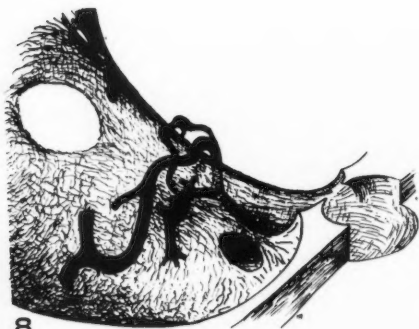
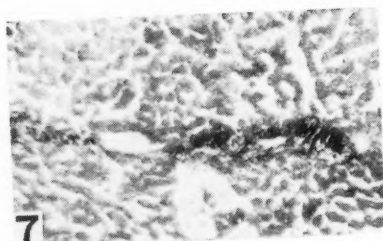
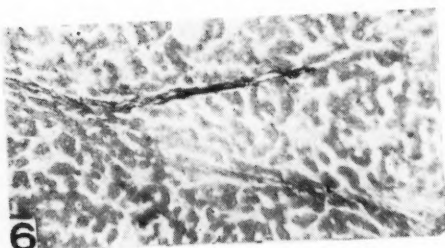




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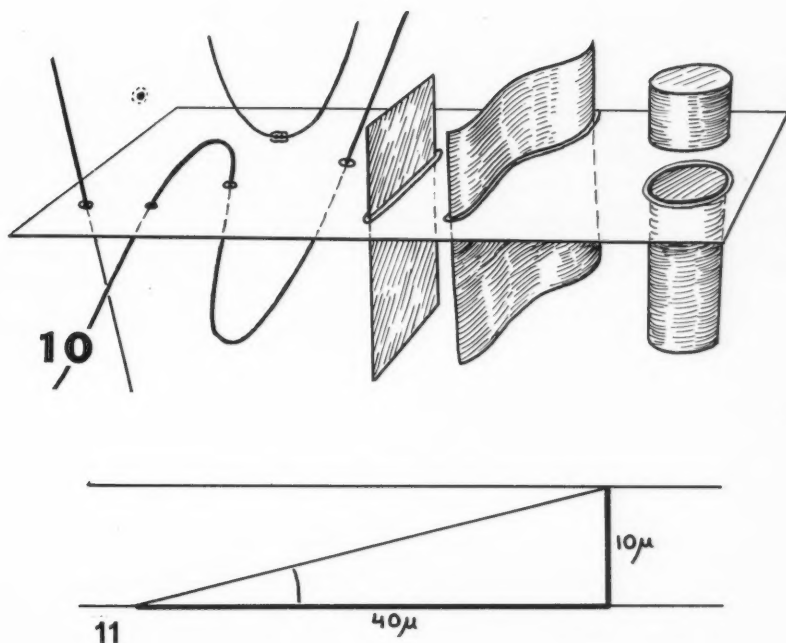
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8



9



EXPLANATION OF FIGURES

1. Stereogram illustrating the verbal descriptions of the liver of the lower vertebrates as pronounced by historical authors, quoted by Elias and Bengelsdorf, 1951. According to this old theory, the vertebrate liver is a net-like, tubular gland.
2. Stereogram showing the actual structure of the liver of the lower vertebrates. This organ is a continuous mass of cells tunnelled by the lacunae.
3. Section of the liver of Torpedo from Krause. This section can be understood on the basis of Figure 2. Krause thought that it showed many longitudinal sections of anastomosing tubules.
4. Illustrates the possibilities of sectioning a single, short tubule. The longitudinal section (right) is the least probable.
5. Illustrates the near-impossibility of sectioning longitudinally a closed mesh of tubules.
6. and 7. Fibrous septa from a human liver affected with Laennec's cirrhosis.
8. and 9. Reconstructions of the septa and blood vessels, sectioned in Figures 6 and 7.
10. Several geometrical objects sectioned by a plane.
11. Diagram to determine the slant of a fiber (see text).

LITERATURE CITED

- Bengelsdorf, Herbert and Hans Elias, 1950. The Structure of the Liver of Cyclostomata. Chicago Medical School Quarterly, 12:7-12.
- Elias, Hans, 1945. Oesophagus and Stomach of Domesticated Birds. Middlesex Veterinarian, 4:97-102.
- , 1948. Growth of the Adrenal Cortex in Domesticated Ungulata. Am. J. of Veterinary Res., 9:173-189.
- , 1949. A Re-examination of the Structure of the Mammalian Liver. I Parenchymal Architecture. Am. J. Anat., 84:311-333.
- Elias, Hans and Herbert Bengelsdorf, 1951. Die Struktur der Leber der Wirbeltiere. Anat. Nachrichten, 1. (Going to press.)
- Kornhauser, W. I., 1948. Intercellular Extensions of Epithelium Inaply Known as Stereocilia. Anat. Rec., 100:53.
- Korzybski, Alfred N., 1948. Science and Sanity. 3rd Ed. New York.
- Krause, Rudolf, 1923. Mikroskopische Anatomie der Wirbeltiere, Vol. 4, Berlin & Leipzig.

THE ULTRAVIOLET RAY MICROSCOPE AND ITS APPLICATIONS

HAROLD KOENIG, M.D., Ph.D.*

In recent years the study of tissues and cells has been extended far beyond the conventional microscopic examination of fixed stained sections. The microscopic realm is now being actively investigated from a number of approaches and is yielding much information of a physical, chemical, and functional nature which is correlated with morphological data. It is the object of this paper to describe one instrument that has increased and promises to increase still further our knowledge of cellular chemistry and morphology, namely, the ultraviolet microscope.

The original purpose of adapting the microscope for use in the invisible ultraviolet spectrum was to increase the resolving power of the microscope. It was known for many years that the resolving power of the microscope, i.e., the power to make small objects which are close together separately visible, depended upon the numerical aperture (N.A.) of the objective and the wave length of the light used. Since the theoretical and practical N.A. of objectives is limited to about 1.6, it is possible to increase resolution, and, therefore, useful magnification, only by utilizing shorter wave length light. Since ordinary optical glass will not transmit short wave ultraviolet light, it is necessary to employ a material like quartz which is transparent to ultraviolet light down to about 2000 Angstroms. Kohler and von Rohr¹, with these considerations in mind, designed a quartz microscope and a monochromatic illuminating system in 1904.

When the quartz microscope is used with ultraviolet light of wave length 2750 Angstroms, the resolving power afforded is double that attainable with the best microscope employing visible light. The electron microscope offers such vastly increased resolving power, however, that ultraviolet microscopy is now rarely used for this purpose alone.

The great advantage of ultraviolet

microscopy lies in the greatly increased contrast which is to be seen in photomicrographs of living or fixed unstained material. This contrast depends chiefly upon the selective absorption of ultraviolet light by specific chemical components present in tissues. To a lesser extent it depends upon the greater differences in refractive index of tissue constituents exhibited at shorter wave lengths. It is the former attribute of ultraviolet microscopy, recognized only in the 1930's, with which this paper is principally concerned. A further characteristic of the ultraviolet microscope is the very short depth of focus when the highest power objectives are used, a characteristic which permits "optical sectioning," or the obtaining of sharp photomicrographs serially at $\frac{1}{4}$ to $\frac{1}{2}$ micron intervals.

Many practical difficulties are encountered in ultraviolet microscopy that are absent in conventional microscopy. Since the objectives are made of only one material, namely quartz, it is not possible to correct these lenses for chromatic aberration, i.e., the failure to focus light of different wave lengths at the same point. These lenses are in fact monochromats and have to be employed with light of a single wave length. In addition to using a light source which yields short wave radiation in high intensity, such as mercury arc or the spark gap set up by high voltage discharges between metal electrodes, an optical system is necessary to provide single wave length radiation. Either a double quartz prism monochromator or a diffraction grating type monochromator is used with accessory quartz lenses to provide monochromatic illumination. It is possible to obtain several single wave lengths in the ultraviolet spectrum with the use of appropriate liquid or gas filters contained within quartz cells placed in front of a mercury arc lamp.

Critical focussing of the image poses another problem, since the image is not visible and can be rendered visible only on a fluorescent screen or in a photo-

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graphic emulsion. The fluorescent screen is useful only in focussing the image prior to photography. The microscope has to be refocussed when the wave length is changed. The recent introduction of reflecting objectives has altered this situation appreciably and will be described later in this article.

A photomicrograph made at 2537 Angstroms of an unstained tissue section (fig. 1) resembles strikingly the tissue section when stained with a basic dye like thionin. The unstained section when viewed or photographed in visible light shows little cellular detail or contrast. It is now known that cell components which stain with basic dyes under suitable conditions contain nucleic acids (with few exceptions). Nucleic acids exhibit an ultraviolet absorption maximum in the neighborhood of 2600 Angstroms which is dependent upon the purine or pyrimidine rings present in these compounds. Proteins have an absorption maximum at 2800 Angstroms which is due to the presence of amino acids containing aromatic rings, like phenyl alanine, tyrosine, and tryptophane. Therefore, photomicrographs made in the neighborhood of 2600 Angstroms should show areas of darkness wherever nucleic acids are located. Similarly, photomicrographs taken at about 2800 Angstroms should show areas of darkness wherever proteins are present in high enough concentrations. The selective absorption of these compounds in the ultraviolet spectrum has long been known and utilized by chemists in gross qualitative and quantitative studies of these materials in solution with spectroscopical methods.

The basis for chemical analyses by absorption spectrophotometry is the Beer-Lambert law:

$$\log \frac{I_0}{I_t} = Kcd$$

where I_0 is the intensity of light incident on the solution or solid, I_t the intensity of light transmitted through the specimen, K is a constant characteristic of the absorbing material and the wave length of light employed, c is the concentration of the absorbing compound, and d is the distance of solu-

tion traversed by the light, usually expressed in centimeters. In practice,

the ratio $\frac{I_0}{I_t}$ is determined in several ways and the optical density, $\log \frac{I_0}{I_t}$ calculated. Where K and d

remain constant, concentration becomes a function of the optical density.

Absorption spectrophotometry was first combined with the ultraviolet microscope by Caspersson² at the University of Stockholm. Most of the groundwork in this intriguing and difficult field was subsequently laid by Caspersson and colleagues. The ultraviolet microscope was thus converted into a quantitative instrument whereby compounds exhibiting selective absorption in the ultraviolet spectrum could be determined quantitatively in amounts far smaller than could be determined with the most sensitive gross chemical methods.

It is not intended to enter into the complex technical details of microspectrophotometry in this paper. Two general methods are available for spectrophotometry, photographic photometry and photoelectric photometry. In the photographic technique, the tissue section or cell is photographed at a series of single wave length and then a clear adjacent area free of the absorbing substance is photographed. During this procedure the photographic plate is calibrated with the aid of a neutral wedge, stepped rotating sector or other device and a curve can then be plotted relating film density to light intensity. The photographic image is then scanned with a microdensitometer and light intensity determined from the plotted curve. This method is inferior to the photoelectric method in accuracy but permits briefer exposures to injurious ultraviolet rays if living tissues or cells are being studied.

Photoelectric photometry is a more direct method. This involves measuring with a sensitive galvanometer the electric current set up in a photoelectric cell when light that has passed through the area under consideration strikes the photocell. This current is then compared with that created when light passes through a similar area and thickness of

the slide which contains no absorbing substance. Thus, the cell or a small part of a cell becomes the test tube or cuvette upon which absorption spectrophotometry may be performed. One such arrangement is seen in fig. 2.

There are, however, several complicating factors which affect the intensity of light which strikes either the photographic film or the photocell after traversing the tissue section or cell. In addition to light being absorbed selectively by a specific chemical, light is lost by reflection, refraction, and scattering at the various interfaces of an optically non-homogeneous material like a tissue section. In gross spectrophotometry this is corrected for by using a "blank" which is identical in composition to the unknown solution except for the absence of the specific absorbing substance. These errors have been carefully studied by Caspersson who has found that specific light absorption or true optical density can be estimated when employing objectives with a N.A. of greater than 1.0 and techniques for mounting tissue sections to minimize light scattering by making appropriate correction for light scattering. Pollister and Ris³ employ a blank which resembles closely that used in conventional spectrophotometry. These investigators take light measurements before and after removal of the specific absorbing material with appropriate techniques. For example, nucleic acids can be selectively removed from the tissue section by extraction with hot trichloroacetic acid³, ribonuclease⁴, or perchloric acid⁵.

Another disturbing factor which is frequently difficult to estimate accurately is the presence of other material which exhibit selective absorption at a given wave length. This is seen particularly when estimating proteins in the presence of nucleic acid in the form of nucleoprotein, for the latter exhibit appreciable absorption at the protein absorption maximum of 2800 Angstroms. This is much less true for the estimation of nucleic acids in the presence of protein, for the latter show weak absorption at 2600 Angstroms. There are other factors which may influence light absorption in a tissue section and much is yet to be learned

about absorption microspectroscopy. Yet in spite of all these limitations, much data has already accrued.

A recent advance in microscope optics has greatly simplified work in the field of ultraviolet photomicrography and absorption microspectroscopy, namely the introduction of reflection objectives or objectives made of mirrors.⁶ Many of the finest telescopes have long been of the reflecting type but only recently have suitable microscope objectives been designed and produced. Reflecting optics are by their very nature achromatic, since the angle of reflection of a light ray is equal to the angle of incidence irrespective of wave length. When a reflecting objective is focussed on an object in visible light, it is in focus for that object at all wave lengths from the short ultraviolet through the far infrared spectrum. It thus becomes feasible to make photographs or absorption measurements at all wave lengths without refocussing. This achromatism is particularly valuable in making ultraviolet photographs of living cells for these can be focussed in visible light and then exposed to damaging ultraviolet rays only for the interval necessary to obtain a photograph. We are currently employing this technique to study the formation and distribution of nucleoprotein in embryonic nerve cells grown in vitro. Another valuable attribute of reflecting objectives is the relatively long working distance afforded as compared with that afforded by conventional refracting objectives of like N.A. and magnifying power. Thus, a reflecting objective giving a magnification of 50 x will have a working distance of 5-15 mm as compared with that of high dry objective with a working distance of about 0.5 mm.

Microabsorption spectroscopy, as described here, can be and is being employed in the visible and infrared portions of the electromagnetic spectrum, as well as in the ultraviolet region. In the visible spectrum, however, only naturally occurring pigments like hemoglobin absorb light selectively to any appreciable extent. In fact, the absorption spectrum of a single red cell has been plotted and resembles very closely that

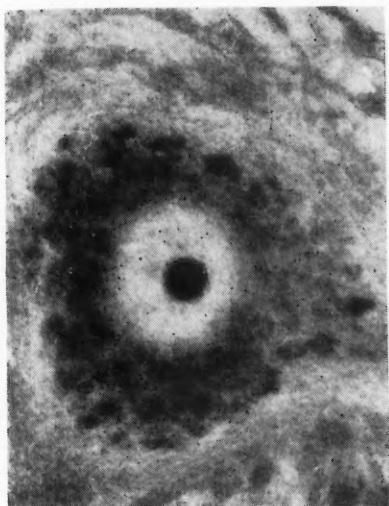


Figure 1

Ultraviolet photomicrograph of a multipolar neurone from a fixed unstained section of spinal cord made at 2537 Angstrom. The nucleolus and cytoplasmic masses, the latter forming the classical Nissl body when stained with a basic dye, are deeply absorbing and appear dark in the photograph. Taken with a 10 X quartz ocular and a glycerin immersion objective, N.A. 1.25, 1200 X magnification.

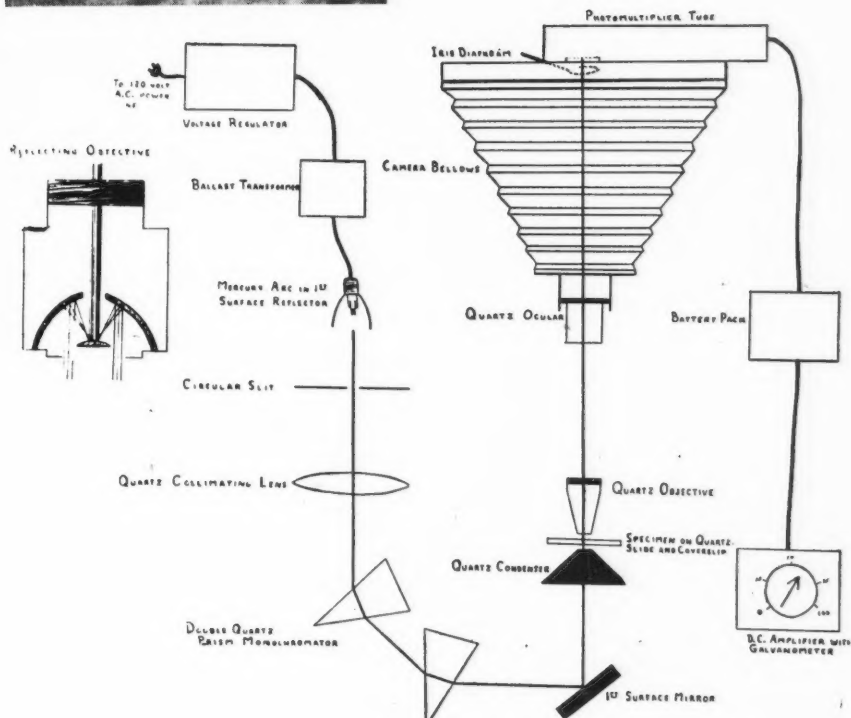


Figure 2

Diagram of one optical arrangement for ultraviolet microabsorption spectroscopy. The light path is indicated with a straight line. The insert is a sketch of one type of reflection objective with a series of light rays to indicate the optical path.

of hemoglobin in solution. However, microchemical reactions which yield a colored end product or dyes which combine stoichiometrically with tissue constituents can be quantitatively studied in the visible spectrum. Infrared microabsorption spectroscopy, made possible with the use of reflection optics, is promising but is limited by the low resolution attainable when long wave length light is employed. In addition to the study of tissues this technique can be used to obtain absorption spectra on small samples of material and even single crystals of pure compounds.

We have briefly reviewed here some of the developments in a relatively new

and promising field of research. This is but one of the many areas in biological investigation where the application of approaches and techniques long found useful in the physical sciences has borne fruit.

REFERENCES

1. Kohler, A., *Ztschrft. f. wissenschaft. Mikr.* 21: 129, 1904.
2. Caspersson, T., *Skandinav. Arch. f. Physiol.* 73: Supp. 8, 1936.
3. Pollister, A. W., and H. Ris. *Cold Spring Harbor Symp.* 12: 747, 1947.
4. Brachet, J., *Comp. rend.* 133: 88, 1940.
5. Koenig, H., Unpublished data.
6. Barer, R., *Brit. Sci. News.* 1: 66, 1948.

CLINICAL PATHOLOGIC CONFERENCE*

This 33 year old white female patient was admitted to Mount Sinai Hospital on January 1, 1950 from another hospital where she had been delivered of a seven month premature infant on December 28, 1949, which died 24 hours later of pulmonary complications. For some time before delivery the patient complained of pain in the back and in the epigastrium, and for several days prior to delivery she had vomited. On the day after delivery she complained of severe epigastric pain for which she was given Pantopon. A blood count on the first postpartum day showed a RBC of 3.15 million and a WBC 53,400. On the second postpartum day the RBC was 2.77 million and the WBC was 123,000. The patient received blood transfusions on the 3rd and 4th postpartum days. Postpartum medication included Pantopon, Penicillin, Streptomycin, Testosterone and Stilbestrol.

Physical examination on admission to Mount Sinai Hospital revealed an apprehensive patient perspiring profusely. Her skin was warm to touch. Temperature was 101°, BP 124/62, Pulse 116 and Respirations 32. There were hemorrhagic lesions on the right cheek, the lower lip and the posterior pharynx. The gums were hyperplastic and bleeding. Crusted blood was present in the nostrils. The conjunctivae were pale. The sclerae were non-icteric. The neck presented a large chain of non-tender anterior and posterior cervical and post auricular nodes. The breasts were painfully engorged. Regular rhythm was present on heart examination; the borders were undetermined. Examination of the lungs revealed normal resonance and breath sounds. A friction rub was present below and lateral to the left breast. The spleen was enlarged to two-three fingerbreadths below the left costal margin and was tender on deep palpation. The liver was enlarged five-six fingerbreadths below the right costal margin and only slightly tender. The inguinal nodes were enlarged.

Hospital Course: The patient progressed very poorly. Her temperature remained around 101° F. She received several blood transfusions and three millicuries of radioactive phosphorus during her hospital stay. On January 6, 1950 many ecchymotic areas were noted on the skin. The scalp was covered with small pustules. On January 7, 1950 the patient became jaundiced and there was partial ptosis of the left eyelid. The following day she became disoriented with hallucinations. On January 10, 1950 she appeared somewhat improved; the liver and spleen were smaller. On January 11th the patient became comatose, and marked dyspnea was present. Skin infiltrations were more marked and were characterized by hemorrhages. There was also a deep, extensive infiltrative type of ecchymosis over the entire abdominal wall. At 3:00 P.M. of that day, the temperature rose to 104.4° and at 6:45 P.M. she expired.

DISCUSSION

Dr. Sherman Kaplan:

I don't think there's much question in anyone's mind but that this patient entered the hospital with a leukemia. The problems were: what was the relation of her pregnancy to the leukemia, and what particular type of leukemia was it. Was it an acute leukemia or a chronic leukemia, a monocytic leukemia or a myelogenous leukemia, and what were we going to do about it?

Acute leukemia is generally characterized by anemia, thrombocytopenia, and immature cells in the peripheral blood, i. e., blast cells. Chronic leukemia is generally characterized by the absence of leucocytosis, no anemia, and no preponderance of blast cells. In addition, splenomegaly is unusual in the acute leukemias, while in chronic leukemia it is the rule. Furthermore, in chronic leukemia, hyperplasia of the gums is not seen, while in both acute myelogenous and acute monocytic leukemia it is common. Thus, this patient presented an overlapping of findings of an acute leu-

* Presented at the Mount Sinai Hospital, Chicago, Illinois.

Laboratory Data:

Blood Count	RBC	WBC	Hb.	Peripheral Blood Smear
1/1/50	2.36	118,000	10.1 Gm.	Cells consisted mostly of immature monocytes. 4% stabs, 7% segs, 10% lymphs, 7% monocytic forms, 3 metamyelocytes, 3 myelocytes, 1% promyelocytes, 1% blasts; 1 normoblast/100 WBC. A small percentage of blast cells were seen.
1/4/50	3.81	81,000	11.1 Gm.	
1/5/50	3.45		10.5 Gm.	A small percentage of blast cells were seen.
1/9/50	3.98		11.7 Gm.	
	Platelet	Bleeding Time	Coag. Time	Clot Retraction
1/1/50	59,000	10½ min.	3½ min.	—
1/4/50	51,000	over 15 min.	20 min.	Not complete in 24 hours.

Blood Chemistry:

1/3/50: Sugar 92 mg.; Urea N. 15.5; Uric Acid 3.94; Icteric Index 24

1/9/50: Chlorides 83.6 mEq/L or 492 mg. %; Sulfa level 1.94; Van den Bergh direct 2.9, indirect 3.7.

Serology: 1/1/50 Negative

Blood Transfusions: 1/2/50 to 1/9/50: Five 500 cc. units of IV O Rh positive whole blood transfusions.

kemia and a chronic leukemia, in that she presented herself with a splenomegaly, which because of its size, antedated her recent delivery; and yet she had a severe anemia, thrombocytopenia, a large number of blast cells and hyperplasia of the gums. In addition, a splenic friction rub was heard. This is quite characteristic and quite common in chronic myelogenous leukemia. Thus, there was an overlapping of findings compatible with acute and chronic leukemia. To make things even more confusing was the fact that the evidence for chronic leukemia bespoke a myeloid type, and yet the immature cells present in the peripheral blood were monocytes. Occasionally one encounters a phase of chronic myelogenous leukemia characterized by the presence in the peripheral blood of immature monocytes, rather than myeloid cells. When the patient enters this stage of the disease, he takes on the added features of an acute leukemia. This has been referred to as the monocytic phase, or Naegeli type, of chronic myelogenous leukemia. It is hard to believe that the magnitude of the splenomegaly presented by this patient, and the findings of splenic infarction would have been the initiating symptoms and findings of an acute leukemia. I would rather think that she had had her disease for some time, that the splenic infarct initiated her labor, and that the chronic myelogenous leukemia went into an acute phase which was rapidly fatal.

One Hundred Ten

Dr. I. Davidsohn, Pathologist:**Blood and Marrow Findings During Life:**

The peripheral blood smear showed an overwhelming majority of cells, larger than any other cells in the blood, having a fine nuclear structure characteristic of monocytes (Fig. 1). The nuclei were lobated, and the cytoplasm has a grayish blue, ground glass appearance. Younger forms of these cells were also seen with a deep blue cytoplasm, visible nucleoli, and less pronounced nuclear lobulation. These were monoblasts.

The bone marrow smears exhibited cells similar to those seen in the peripheral blood, mainly monocytes and monoblasts, but in addition immature myeloid cells such as myelocytes, and also reticulum cells.

Autopsy Findings:

BONE MARROW section from post-mortem material revealed complete replacement of marrow by proliferating monocytes and monoblasts. Only very few megakaryocytes and erythroid cells were left.

The LYMPH NODES were only moderately enlarged, measuring up to 2 cm. in diameter. Microscopic examination showed that they had been almost completely replaced by monocytes (Fig. 2) leaving only small islands of normal lymphoid tissue. Many of these cells demonstrated marked mitotic activity. According to the present conception these cells are regarded as of reticulo-endothelial origin. Similar cells with lobated

The Quarterly

nuclei were also found in the peripheral organs. Megakaryocytes were also present in the peripheral organs.

The SPLEEN weighed 1400 Gm. It showed extensive infarction. The diaphragm was adherent to the infarcted area, this finding accounting for the friction rub that was heard. Microscopic sections showed infiltration with cells of the same type as those seen in the lymphoid tissue and in the peripheral blood. A great many megakaryocytes were also found. The trabecles appeared to be eaten away by the leukemic cells (Fig. 3). This finding was described among others by the late Dr. R. H. Jaffe in leukemia, myelocytic as well as monocytic. In addition to leukemia this process can be seen in infectious mononucleosis, where this kind of rapid eating away of the capsule as well as of the trabecles is said to be largely responsible for the rare complication of spontaneous rupture of the spleen. Some veins within the splenic trabecles showed the wall to be infiltrated with immature monocytic cells (Fig. 4), which may have some bearing on the peripheral blood picture. This finding is also described in infectious mononucleosis.

Such changes in the veins tend to support the contentions of those who hold that all the abnormal cells seen in the peripheral blood in leukemias come from extramedullary areas of hematopoiesis. Understandably, such a structure could constantly feed these abnormal cells into the peripheral blood. The lumen of a splenic vein was closed by a thrombus, thus accounting for the splenic infarct noted grossly. The capsule of the spleen was thinned, had a smooth outer surface, and seemed to be infiltrated by the same cells which continued to digest the capsule. In another area the outer surface was covered with a fibrinous exudate, advancing to a fibrinous perisplenitis. This is no doubt an early change which later may lead to adhesions with the adjacent structures such as the diaphragm.

The LIVER was enlarged, weighing 3400 Gm. The sectioned surface revealed grayish areas of infiltration, which microscopically were made up of monocytic leukemic cells infiltrating the periportal

tissues around the bile ducts and into the sinusoids. Besides simple infiltration, there were areas of actual colonization of the leukemic cells within the sinusoids. A cavernous hemangioma was present, in the walls of which there were also leukemic infiltrations.

The KIDNEYS weighed 720 Gm., as compared with a normal of about 250 Gm. The outer aspect presented yellow mottled areas which were infiltrations with the same monocytic cells. The tubules were widely separated by leukemic infiltrations. Some glomeruli were hyalinized.

The UTERUS had a grossly hemorrhagic appearance in the endometrium and myometrium. The large venous sinuses were infiltrated by the same leukemic cells. The cervix was similarly infiltrated by leukemic cells and also showed many megakaryocytes. The breast revealed the expected postpartum changes, but the interstitial tissues were infiltrated by leukemic cells.

HEMORRHAGES were present in various mucosal and parenchymatous structures and in the skin. Purpuric changes in the pelvic mucosa were seen on the sectioned surface of the kidney. The mucosa of the ureter, urinary bladder, esophagus, and stomach presented similar extensive purpuric changes. Parenchymatous hemorrhages were evident in the lungs, presenting a hemorrhagic infarct without destruction of tissue.

Leukemic infiltrations were present also in the ADRENAL and periadrenal tissues, and in the GALLBLADDER and the SKIN.

Very small foci of leukemic cells were found in the BRAIN and in the anterior lobe of the PITUITARY GLAND.

Anatomic Diagnosis:

Monocytic leukemia with involvement of bone marrow, lymph nodes, (axillary, peribronchial, mesenteric, and others), internal organs (heart, lungs, liver, gallbladder, pancreas, spleen, adrenals, kidneys, uterus, cervix, ovaries, brain, pituitary), skin, and breast. Hemorrhages of the skin (purpura), heart (epicardium), pleura, stomach (mucosa), spleen, renal pelvis and ureters, myometrium and cervix uteri. Hemorrhagic infarct of lungs

and anemic infarct of spleen. Thrombosis of splenic vein. Hypertrophy of pregnancy of the uterus (early puerperal), and hyperplasia of pregnancy of the breast. Cavernous hemangioma of the liver. Acute toxic nephrosis of the kidneys.

Cause of Death:

Monocytic leukemia.

Summary and Discussion:

The pathologic findings were those of a monocytic leukemia. The classification of this type of leukemia has been a source of much discussion. At one time, the existence of a monocytic leukemia was denied entirely, when it was recognized as being a phase of myeloblastic and myelocytic leukemia. At the present time, monocytic leukemia has been definitely recognized as an entity. In most cases it is either an acute or subacute form, the latter no doubt existing in this case as evidenced by the extensive change. A spleen of 1400 Gm. is quite unusual for a monocytic leukemia, but cases of monocytic leukemia with a spleen of that size have been reported. The disease was present for several months. The usual duration of monocytic leukemia is from a few weeks to five or six months. It is quite possible that this patient had this condition for all that time. Maybe the abdominal pain had something to do with it.

The patient presents also the problem of the relation between pregnancy and leukemia. Whether the pregnancy will accelerate or aggravate the course is speculation. The relation of pregnancy, a common lesion, to a lesion as rare as monocytic leukemia may be purely coincidental. An autopsy was performed on the newborn child delivered by this patient and dying soon thereafter which revealed no evidence of leukemia.

When all types of leukemia are classified, the myelocytic or so-called myelogenous leukemia constitutes approximately 63 per cent of all leukemias, lymphocytic 32 per cent, and monocytic 5 per cent. It has been pointed out by Rosenthal that this is also the incidence of myeloid cells, lymphatic cells, and monocytes in the peripheral blood.

There is considerable discussion in the

literature on the origin of monocytes. Some derive them from lymphocytes, others from reticulo-endothelial cells. At the present time the consensus is that they are of reticulo-endothelial origin, and some even call this type of leukemia a reticulo-endothelial leukemia or reticulo-endotheliosis. There is evidence that these cells not infrequently show ability to phagocytose other red cells.

Dr. S. Kaplan:

Was there massive cerebral hemorrhage in this case?

Dr. I. Davidsohn:

No, there was no massive cerebral hemorrhage at all, just a few petechial hemorrhages. An extensive bronchopneumonia was present, which was the final complication. As previously pointed out there were hemorrhagic manifestations in this case, but there were no unusual hemorrhagic changes in the brain. The bone marrow showed only very rare megakaryocytes. Areas in the lymph nodes, spleen, and even in the cervix, had large numbers of megakaryocytes. The presence of such large numbers of megakaryocytes all over the body does not necessarily mean that they were able to supply the platelets, because they may not be functioning properly. Most of the patients die from either hemorrhage or infection. The final and immediate cause of death was broncho-pneumonia.

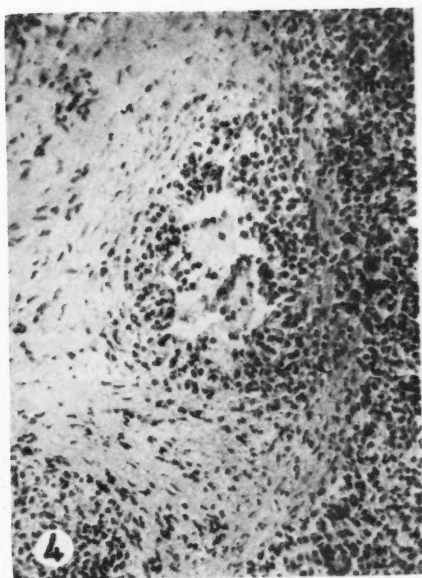
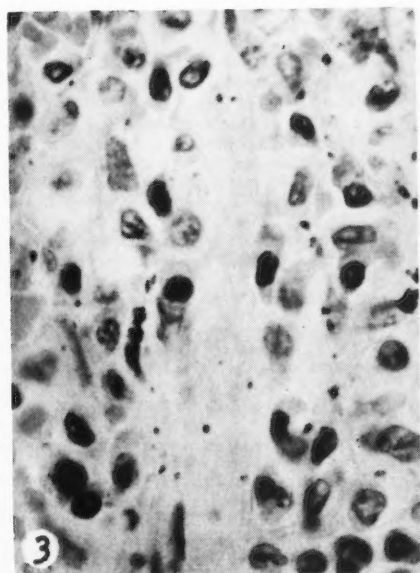
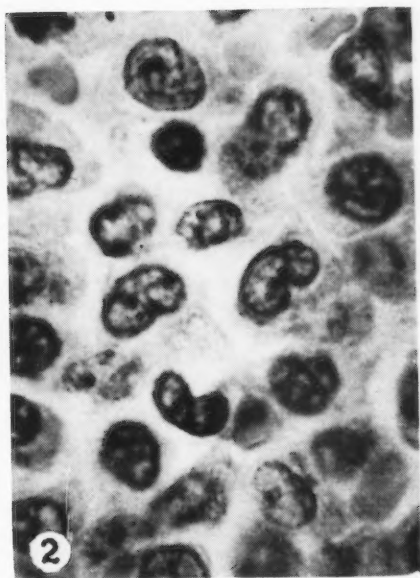
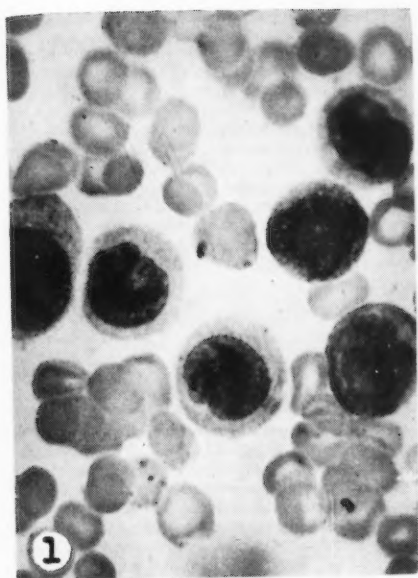
LEGENDS OF ILLUSTRATIONS

Fig. 1: The peripheral blood smear presented monocytes having a fine nuclear structure, lobated nucleus, and a ground glass cytoplasm. Younger forms had visible nucleoli and a less pronounced nuclear lobulation. Photomicrograph $\times 1100$.

Fig. 2: The lymph nodes were almost completely replaced by monocytic or reticulo-endothelial cells. Some of them were in mitoses. Photomicrograph $\times 1500$.

Fig. 3: A splenic blood vessel in a trabecule showed proliferation of leukemic cells beneath the intima. This lesion may facilitate entry of leukemic cells into the circulation and may explain the breakdown of the blood-tissue barrier in leukemia. Photomicrograph $\times 150$.

Fig. 4: Spleen: Trabecle thinned out and partly replaced by leukemic cells. Photomicrograph $\times 700$.



BOOK REVIEWS

TEXTBOOK OF GYNECOLOGY by Arthur Hale Curtis, M.D. and John William Huffman, M.D. Cloth. Sixth edition. 797 pages with 466 illustrations. Philadelphia and London: W. B. Saunders Company, 1950. \$10.00.

Previous editions of this work had been presented by Dr. Curtis alone. Since his retirement from active clinical and academic duties, he now collaborates with Dr. Huffman. All the chapters have been revised, most noteworthy those on embryology, ovarian tumors and problems relating to the urinary tract. Many illustrations have been added. The book is clearly written and beautifully illustrated. The section on pelvic anatomy is admirably presented by Drs. Curtis and Barry Anson in collaboration, with illustrations by Tom Jones. The book continues to be a leading textbook in gynecology, and as such it is highly recommended to students and to practitioners.

SKULL FRACTURES AND BRAIN INJURIES by Harry E. Mock, M.D. Cloth. 806 pages with 116 illustrations. Baltimore: The Williams and Wilkins Company, 1950. \$13.50.

This book is based on the thesis that brain injury accompanies most skull fractures. The book, written by a general surgeon, is directed to the general surgeon and to the general practitioner in whose hands rest the diagnosis and early treatment of injuries to the head. The author freely cites illustrative cases from the thirty years of his experience and research in this field. Brain and skull injuries are discussed from all aspects and points of view. The author writes in an individual, interesting and readable style, emphasizing his points effectively. The use of case studies (230 in all) for illustration are of practical value. The figures are excellent. This vital subject of brain injury is skillfully treated in this book. On this basis it is strongly recommended to students, practitioners, and surgeons.

PATHOLOGIC PHYSIOLOGY. Edited by William A. Sodeman, M.D. Cloth. 808 pages with 146 illustrations. Philadelphia and London: W. B. Saunders Company, 1950. \$11.50.

Written by collaboration of 25 authors, this book is an excellent dissertation on the pathophysiology of signs and symptoms. The concept of disease as physiologic dysfunction is presented. The result is a bridge between the fields of physiology and medicine, a useful adjunct to the study of either. The organization is by systems (in the early part of the book) and by agents of disease (in the latter). The discussions are brief and pointed. Illustrations are, for the most part, diagrammatic. Some roentgenograms are included. Students and clinicians will both find this book of inestimable value in contributing to the understanding of the disease process.

PHYSIOLOGY OF THE EYE by Francis Heed Adler, M.D. Cloth. 709 pages with 319 illustrations. St. Louis: C. V. Mosby Company, 1950. \$12.00.

This book is written with the intent of providing a background in physiology to clinical ophthalmology. The author draws freely from ex-

perimental data and demonstrates the clinical application wherever possible. The physiologic principles underlying normal functions, alter function in disease, and therapeutics are discussed. The book is organized according to anatomy, in the first part of the book, and according to the various phenomena of vision in the latter part. Illustrations are diagrammatic and serve well to elucidate the principles under discussion. The book is well written and serves a useful purpose. It is highly recommended to ophthalmologists and others interested in the function of the eye.

REGIONAL ORTHOPEDIC SURGERY by Paul C. Colonna, M.D. Cloth. 706 pages, 474 figures. Philadelphia and London: W. B. Saunders Company, 1950. \$11.50.

This new textbook in orthopedic surgery emphasizes the correlation of orthopedics with other branches of medical art. The book begins with sections on general orthopedics, physiology, pathology, and examination. The bulk of the book is regional in approach. For each region the author describes anatomy method of examination, diseases, injuries and deformities. Following these, there are sections on neuromuscular disabilities, tumors of bone, and principles of apparatus and of physical therapy. The book is concise, clear, and complete. Illustrations include drawings, photographs and roentgenograms. These are well selected and add considerably to the value of the book. It is highly recommended as a text in orthopedics.

PHYSICAL EXAMINATION IN HEALTH AND DISEASE by Rudolph H. Kampmeier, M.D. Cloth. 814 pages with 551 illustrations. Philadelphia: F. A. Davis Company, 1950. \$8.00.

This new textbook in physical diagnosis differs from its predecessors in both simplification and amplification. The organization is simplified by arrangement of the chapters in pairs. The first presents the technique of examination together with a description of the normal, and the second describes the abnormal of the same region. The physical findings are interpreted in terms of their pathology, physiology, and anatomy. The book is well illustrated. Drawings are usually superimposed upon x-rays or photographs. Illustrations of malignancies are selected to show the early minimal changes. The book is highly recommended to students and practitioners.

ENCYCLOPEDIA OF THE EYE by Conrad Berens, M.D. and Edward Siegel, M.D. Cloth. 272 pages with 76 illustrations. Philadelphia, London, Montreal: J. B. Lippincott Company, 1950. \$5.00.

This is a reference work on the diagnosis and treatment of the more common ophthalmologic problems. The organization is alphabetical. Pediatric ophthalmology is stressed. The book is intended as a practical aid to physicians, students, nurses, and social workers as well as ophthalmologists and optometrists. It will be found of value for quick and ready reference.

MEDICAL DIAGNOSIS. Edited by Roscoe L. Pullen, M.D. Cloth. Second edition. 1119 pages with 601 illustrations. Philadelphia and London: W. B. Saunders Company, 1950. \$12.50.

Written by 23 contributors, the second edition of this work more effectively stresses the correlation of history, bedside examination, laboratory, and roentgenological techniques in the pursuit of a diagnosis. New chapters include those on the diagnosis of blood diseases, of conditions in the aged, and of the psychiatric patient. Other chapters have been extensively revised or rewritten. Using the principles of physical diagnosis, the author stresses the need for complete examination of the entire body and for development of proficiency in every part. The chapters are arranged, for the most part, according to regions, followed by a series of correlative chapters such as the endocrine survey, blood, psychiatric, etc. Illustrations are numerous and are well chosen. The book is highly recommended.

METHODS IN MEDICINE by George R. Herrman, M.D. Cloth. Second edition. 488 pages. St. Louis: C. V. Mosby Company, 1950. \$7.50.

This is a manual of medical practice. It serves as a guide for medical investigation and work-up of most of the medical conditions encountered in practice. The methods are presented in concise, clear, and logical fashion. The book is divided into five parts: Part I deals with routine case study; Part II with laboratory procedures; Part III with special studies in various disorders; Part IV with therapeutic methods; and Part V with dietetic methods. When supplemented by adequate medical background this book will be found useful to the student and practitioner as a guide in the methods of practical medicine.

THE MANAGEMENT OF OBSTETRIC DIFFICULTIES by Paul Titus, M.D. Cloth. Fourth edition. 1046 pages, 446 illustrations, and 9 plates. St. Louis: C. V. Mosby Company, 1950. \$14.00.

The fourth edition of "Titus" brings up to date the developments in obstetrics during the past five years and since the war. Certain chapters have been completely rewritten. Uniformity in definitions, terminology, and agreement on classifications and procedures have been attempted by this author in collaboration with other authors of books on obstetrics. The book is written as a practical aid to the physician in his encounter with obstetric emergencies and complications. It is assumed that the reader is familiar with normal obstetrics including fundamentals and theories. The book is enriched by the author's own observations and experiences in the handling of obstetric difficulties. The book is highly recommended to advanced students, residents, and practitioners of obstetrics.

PRINCIPLES AND PRACTICE OF SURGERY by Jacob K. Berman, M.D. Cloth. 1378 pages with 429 illustrations. St. Louis: C. V. Mosby Company, 1950. \$15.00.

This work in fundamentals of General Surgery is written with the thesis of correlating basic sciences with the principles of surgery. To this end, the author has drawn freely upon the fields of embryology, anatomy, histology, physiology,

pathology, etiology, biochemistry, and the other fields of basic medical science. References are extensive in both the text and the bibliographies at the end of each chapter. The book is written in an interesting, easily readable and often conversational style. Specific cases are often cited for clarity. Illustrations are excellent. Experimental data and that part of surgery which the author characterizes as "unconquered territory," appears in fine print and is included as a stimulus to the student to pursue the subject in the literature. The book is highly recommended to the surgeon and to the student of surgery.

FUNCTIONAL ANATOMY OF THE LIMBS AND BACK by W. Henry Hollinshead, Ph.D. Cloth. 341 pages with 122 illustrations. Philadelphia and London: W. B. Saunders Company, 1951. \$6.00.

The anatomic descriptions in this book cover the muscles, bones, joints, and nerves of the body. The organization is regional, and the approach entirely functional. Drawings are uniform and diagrammatic—excellent for teaching. The descriptions of movement, together with their illustrations, are particularly distinctive. The book will be found of value to those interested in the functional approach to anatomy, notably those in the fields of physical medicine, orthopedics, and neurology, as well as to their technicians and students.

EYES AND INDUSTRY by Hedwig S. Kuhn, M.D. Cloth. Second edition. 378 pages with 151 illustrations. St. Louis: C. V. Mosby Company, 1950. \$8.50.

This is the first book, to date, devoted to the specialized problems of industrial ophthalmology. It is based, in part, on the results of the study conducted by the Joint Committee of Industrial Ophthalmology of the American Academy of Ophthalmology and of the Section on Ophthalmology of the American Medical Association, and in part on the author's experience. Chapters cover eye testing for industry, standards, injuries by mechanical, radiation and chemical causes, eye protection, illumination, and the role of the blind in industry. The book is complete with illustrations, tables, and references. It is highly recommended to ophthalmologists and industrial physicians.

SURGICAL NURSING. By Eldridge L. Eliason, M.D., L. Kraeler Ferguson, M.D., and Lillian A. Sholtis, R. N. Cloth. Ninth Edition, 671 pages with 336 illustrations. Philadelphia, London Montreal: J. B. Lippincott Company, 1950. \$4.00.

The ninth edition of this book stresses nurse-patient relationships in the care of the surgical patient. This leads to consideration of the social, economic, public health nutritional and mental aspects of the patient's illness. Freely illustrated and simply written, the book succeeds in presenting the role of the nurse in the care of the surgical patient from diagnosis to rehabilitation. It is recommended to student and graduate nurses. Physicians and surgeons will find the book helpful in their cooperation with the nurse.

SCHOOL NOTES AND NEWS

FACULTY NEWS

We would like to take this opportunity to welcome Dr. Russell O. Hanson to the pre-clinical staff as Instructor of Pharmacology in the Department of Physiology and Pharmacology of The Chicago Medical School.

Dr. Hanson, born in Chicago in 1916, received his Bachelor of Science degree in chemistry from the Illinois Institute of Technology in 1940. Upon his graduation, Dr. Hanson was employed at the Armour Laboratories as a research assistant and specialized



Dr. R. O. Hanson

in control work in chemistry. In 1941, he began teaching and taught in various schools in Michigan until 1946, when he entered the University of Wisconsin where he completed his research for the Doctor of Philosophy degree under the supervision of Dr. A. M. Tatum. Dr. Hanson received his Ph.D. in pharmacology in 1950. His doctorate thesis was concerned with the chemotherapy of avian malaria.

Dr. Hanson is a member of the Gamma Alpha Scientific Fraternity and the Society of Sigma Xi. At the present time, he is continuing his work on the anti-malarial drugs and intends to do research on the actions of the ergot derivatives on the gastro-intestinal tract.

* * * * *

Dr. John J. Sheinin, President of The Chicago Medical School, has been elected a Fellow of the American Geriatrics Society, an honorary member of the Illinois Chapter of the American Academy of General Practice and has been appointed to the Committee on Emergency Medical Service of the Chicago Medical Society.

Dr. Karl A. Menninger delivered the Second Maurice Oppenheim Memorial Lecture on January 24, 1951 at the Kling Auditorium of the Mount Sinai Hospital

of Chicago. Sponsored by the Alpha Rho Chapter of the Phi Lambda Kappa Fraternity, the topic of Dr. Menninger's speech was, "Psychiatry and Medicine."

Dr. Harry H. Garner, Professor and Chairman of the Department of Neurology and Psychiatry has been appointed to the Advisory Committee, Mental Hygiene Section, Chicago Board of Health.

Dr. Aldo A. Luisada, Assistant Professor of Medicine and Program Director of Cardiology was elected a member of the Research Committee of the Chicago Heart Association.

Dr. A. R. Goldfarb has been appointed Editor (Biophysics) of the Digest of Laboratory and Tropical Medicine.

Dr. M. S. Nechtow and Dr. Walter S. Reich, Assistant Professors of Gynecology, have been elected to the Medical Writers Association of America.

Dr. Louis Mallow, Instructor in Surgery, has been certified by the American Board of Surgery.

Dr. Lawrence Mann, Instructor in Surgery, has been certified by the American Board of Surgery and has been elected a Fellow of the American College of Surgeons.

Dr. Harold S. Feinhandler, Instructor in Ophthalmology, has been certified by the American Board of Ophthalmology.

Dr. Harry F. Weisberg, Associate in Medicine, has been elected to the Society for Experimental Biology and Medicine.

Dr. Walter A. Adams, Associate in Psychiatry, has been elected to the Institute of Medicine and has been appointed a Psychiatric Consultant of the Anti-Defamation League.

Dr. Bernard K. Galston, has been elected a Fellow of the International College of Anesthetists.

Dr. Harry H. Garner, Chairman of the Department of Neurology and Psychiatry has been appointed to the Illinois Psychiatric Research Council.

Dr. Walter Reich and Dr. M. J. Nectow, Assistant Professors of Gynecology were awarded second prize—a bronze medal—for the exhibit, "Practical Gynecology" at the Mississippi Valley Medical Society Annual Meeting at Springfield, Illinois.

Dr. Bernard Rosenblum, Class of 1938, and Assistant in Medicine has been appointed to the United States Public Health Service with the rank of Surgeon.

Dr. Louis Berlin, Associate in Neurology at The Chicago Medical School and Alumnus of the Class of 1940 announces the opening of his office for the practice of Neurology in Chicago, Illinois.

Dr. George C. Coe, Assistant Professor of Medicine and Dr. Hyman J. Hirshfield are happy to announce their association in the practice of internal medicine in Chicago, Illinois.

Dr. Aaron A. Mannis, Instructor of Clinical Ophthalmology, announces the opening of offices for practice of ophthalmology in Chicago, Illinois.

Dr. Leonard A. Stine has received the Diplomate of the American Board of Internal Medicine, having recently completed his examinations.

Congratulations to Dr. Leroy P. Levitt, Class of 1943 and Assistant in Psychiatry at The Chicago Medical School, on his marriage to Miss Judith Ulrich of Chicago, Illinois.

Congratulations are in order to Dr. and Mrs. Lawrence S. Mann on their marriage on June 25, 1950. Dr. Mann is an Instructor in Surgery at The Chicago Medical School.

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We wish to extend our congratulations to Miss M. E. Campbell, Librarian of The Chicago Medical School, on her election to active membership in the American Association of the History of Medicine. This is an association composed of scholars and notable men and women of Science in the library field.

Dr. Maxwell P. Borovsky, Professor and Chairman of the Department of Pediatrics, has been elected Treasurer of the Chicago Pediatrics Society.

Faculty Promotions

Department of Ophthalmology

Instructor: Dr. Harold S. Feinhandler

New Faculty Appointments

Department of Anatomy

Assistant: Dr. William O. Ackley

Department of Gynecology and Obstetrics

Instructor: Dr. Rudolph B. Edelstein

Assistants: Dr. Howard L. Ganser, Dr.

Howard M. Seidner, Dr. Samuel O. Zaidenberg

Department of Medicine

Associate: Dr. Stanley E. Telser

Department of Neurology and Psychiatry

Associate: Dr. Jerome S. Beigler

Department of Otolaryngology and

Rhinology

Instructor in Otolaryngology: Dr. Marshall U. Simon

Department of Pediatrics

Assistant: Dr. Moshe Lev

Department of Surgery

Instructor: Dr. Robert C. Busch

Associate: Dr. Lawrence Jacques

Assistant in Neuro-Surgery: Dr. Kimbell Ross-Duggan II

Assistant in Orthopedic Surgery: Dr. Maxwell M. Corbett (Alumnus), Dr.

Colbert Smith Davis

Department of Anatomy

At the present time, Dr. Harold Koenig, Assistant Professor of Gross Anatomy at The Chicago Medical School is investigating certain phases of cell structure, chemistry and function—and their inter-relationships—in nerve cells. To aid in this work, Dr. Koenig has assembled equipment for photomicrography and absorption microspectrophotometry in the visible and ultra violet spectra. This includes quartz optics for ultraviolet light transmission and reflecting objectives which can be used in the ultraviolet, visible and infrared regions of the spectrum without refocussing. In conjunction with appropriate light sources, filters and an electronic photometer, Dr. Koenig is making quantitative determinations of chemical constituents within cells, particularly nucleoproteins, and the changes produced under certain experimental conditions. He is also employing this equipment to study the state of the Nissl substance in the living neurons and in developing a cytochemical method for selective extraction of ribose and desoxyribose nucleic acids from mammalian tissues.

ALUMNI NEWS

Class of 1950

Congratulations to Dr. and Mrs. Herbert Fishbein on their marriage on September 9, 1950, in Chicago. Mrs. Fishbein is the former Adele Rosen of Mount Sinai Hospital.

Dr. Lawrence D. Elegant has been appointed Resident in Pediatrics at Michael Reese Hospital in Chicago.

Dr. Maurice J. Sherman has been appointed Resident in Medicine at Veterans' Administration Hospital, Hines, Illinois.

Class of 1949

Both Dr. William H. Rubin and Dr. Harold P. Surchin have been appointed Junior Residents in Psychiatry at King's County Hospital, Brooklyn, New York. They passed the New York State Board examinations in October, 1950, and are now licensed to practice medicine in New York State.

Class of 1948

Dr. Carl Weiner has been appointed Resident in Anesthesiology at Michael Reese Hospital, Chicago.

Class of 1947

Dr. Jerome A. Ehrlich announces the opening of his office at 1 Burbank Street, Yonkers, New York.

Dr. Ehrlich is also track physician for Yonkers Raceway and examining physician at the Selective Service Board of Yonkers. He has also been recently elected to the Academy of Medicine, Yonkers, New York.

Class of 1946

Congratulations are in order to Dr. Bernard Shulman on his engagement to Miss Phyllis Mann of Chicago.

Dr. Marvin Ziporyn has been appointed Senior Assistant Surgeon with the United States Public Health Service. He is Laboratory Director of the United States Marine Hospital at Fort Stanton, New Mexico, where he is doing medical research, and has published papers in the *Medical Times* and *Annals of Western Medicine and Surgery*.

Class of 1945

Congratulations to Dr. and Mrs. Marvin B. Rodney on the birth of their daughter, Katherine Louise, on November 8, 1950.

Best wishes to Dr. and Mrs. Arthur B. Sincoff on the birth of a daughter, Jane

Ann, on December 18, 1950, in New York City.

Congratulations to Dr. Harold J. Sanders on his marriage to the former Susanne Emely, of Chicago, on February 11, 1951.

Class of 1944

Dr. Milton Wohl has been appointed Captain in the Army Medical Corps.

Dr. Bernard K. Galston has been elected a Fellow of the International College of Anesthetists.

Class of 1943

Dr. Arthur Howard is practicing medicine in Johnstown, New York, and has been appointed Assistant Attending Physician in Medicine in Littauer Hospital, Gloversville, New York. He is a member of the Academy of General Practice.

Dr. Victor P. Slepikas has been commissioned Captain in the Army Medical Corps.

Congratulations to Dr. and Mrs. M. J. Graff on the birth of their fifth child, a boy, on December 6, 1950. Dr. Graff announces the opening of a new office at 15320 Page Avenue in Harvey, Illinois.

Best wishes are in order to Dr. and Mrs. Robert M. Younglove on the birth of their son, Robert Hal, on October 8, 1950.

Class of 1942

Dr. Abraham Schwartz has been certified a Diplomate of the American Board of Psychiatry and Neurology.

Dr. Gerald L. Haidak has been elected a Fellow of the National Gastroenterological Association.

Class of 1941

Dr. Arnold S. Black has been certified by the American Board of Internal Medicine.

Class of 1939

Congratulations to Dr. and Mrs. P. P. Ferraccio on the birth of their son on November 12, 1950.

Class of 1938

Dr. Lawrence R. Medoff announces the opening of his medical clinic in Miami, Florida.

Dr. Paul Egel has recently been elected a Fellow of the International College of Surgeons.

Class of 1934

Dr. Joseph P. Cangelosi of Chicago has been elected an Associate Fellow of the

National Gastroenterological Association, and has also been elected Fellow of the International Academy of Proctology.

Dr. Louis B. Goldman has been certified by the International Academy of Proctology and is also a member of the American Gastroscopic Society.

Class of 1932

Dr. Francis X. Graff has been elected a Fellow of the International College of Surgeons.

Class of 1929

Dr. Louis A. Kopple has been elected Master of the Prudence Lodge.

The Faculty and Alumni Association extend their heartfelt sympathy to the families and friends of these honored dead:

Dr. Lawrence L. Iseman, Professor of Surgery

Dr. Henry S. Sherman, Associate in Obstetrics

Dr. Albert H. Atwood—Class of 1906

Dr. William J. Schaffer—Class of 1906

Dr. Albert Martin—Class of 1916

Dr. Robey A. Crum—Class of 1932

STUDENT NEWS

Class of 1951

Congratulations to Arthur and Ruth Bressler on the birth of a daughter, Judith, on June 28, 1950.

Best wishes to Masaharu and Mitzi Kokunaga on the birth of a daughter, Sandra, on January 7, 1950.

Congratulations to Dr. and Mrs. Claude Udckoff on the birth of a son, Ranon Charles, on January 23, 1950.

Best wishes to Mr. and Mrs. Bernard Teitel on the birth of a son, Richard David, on July 25, 1950.

Congratulations to Mr. and Mrs. Jerome J. Podgers on the birth of their daughter, Jennifer Audrey, on January 19, 1951.

Best wishes to Mr. and Mrs. Sanford F. Gaylord on the birth of their son, Scott David, on January 28, 1951.

Congratulations are extended to Mr. Adolph Boltax on his engagement to Miss Kay Mutchnick of Chicago.

Best wishes to Mr. Morton J. Doblin on his engagement to Miss Arline Perl-

man of Chicago. Both the above couples plan to be married on June 24, 1951.

Class of 1952

Congratulations to Bob Katz and Marie Sathmary, both of the class of 1952, on their marriage on December 30, 1950.

Best wishes to Irving Rosenberg on his marriage to Joan Rothenberg of Orange, New Jersey.

Congratulations to Mr. and Mrs. Nelson Rangell on the birth of a son, Robert Shaw, on January 17, 1951.

Best wishes to Mr. and Mrs. Roland Kowal on the birth of a son, Roland Trent, on February 19, 1951.

Class of 1953

Congratulations to Donald Behr and the former Miss Barbara R. Price of New York City on their marriage, December 19, 1950.

Best wishes to Eugene Shatkin on his marriage to the former Miss Joyce Cooper of Oakland, Calif., on March 25, 1951.

Congratulations to Robert J. Langs and Miss Joan H. Schwartz on the recent announcement of their engagement.

Class of 1954

Best wishes to Ervin Mosovich on the occasion of his marriage to the former Miss Naomi Walensky of Glen Ridge, New Jersey, on March 20, 1951.

Best wishes are also in order to Melvin Samuels on his marriage to the Former Miss Charlotte Weinberg of Los Angeles, Calif., on December 24, 1950.

Congratulations to Walter Jacobs and Miss Dorothy Joan Kaplan of Brooklyn, New York, on the announcement of their engagement.

Congratulations also to Sheldon L. Schein on his engagement to Miss Lila Stumacher of Brooklyn, New York.

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ORGANIZATION NEWS

Student Council

The Student Council began the current year with a meeting held on October 18, 1950. Officers were elected and plans were made to form a dynamic cooperative unit of faculty and students to facilitate handling of important affairs affecting both groups. The officers elected were: President, Melvin Eisenberg; Vice-President, Stuart Cohen; Secretary, Jack Handel; and Treasurer, Robert Langs.

The ideas and plans formulated at that and subsequent meetings were put into action and the directory of students and faculty, for which there has long been a need, was compiled. Fortunately, the council was able to secure three advertising sponsors; therefore the selling price will be negligible.

With the donation of a mimeograph machine to the S.C., the work of its constituent organizations, as well as the council itself, has been given an impetus. For its operation a committee has been appointed and will be available for contact by students and faculty.

We would like to express our appreciation of the approval accorded our new bi-quarterly publication, *THE FORAMEN*. It is designed to inform the student body and the faculty of the organization's proceedings and policy.

Phi Lambda Kappa

The second annual Maurice Oppenheim Lectureship was held at the Kling Auditorium of the Mount Sinai Hospital on January 24, 1951. Alpha Rho chapter of the Phi Lambda Kappa Fraternity was especially privileged to have for their speaker one of the foremost psychiatrists in the country, Dr. Karl Menninger, of the world famed Menninger Clinic in Topeka, Kansas. Dr. Menninger spoke on the subject of "Psychiatry and Medicine" before an audience of some 800 people. The reception of this lectureship by the student body and by the members of the staff has been very gratifying to all the members of our fraternity who have brought it about. Special thanks must go to the educational chairman, Maurice Laszlo, whose efforts made Dr. Menninger's appearance possible.

Over the Christmas holidays many members of Alpha Rho Chapter took advantage of the fact that the National Convention of Phi Lambda Kappa Fraternity was held in Chicago. Several members besides the delegates were present at many of the business meetings and at the social functions. Mel Pick and Norm Blass, the convention delegates, told those members who left Chicago that week, what they had missed in the way of fun at the convention affairs.

The annual initiation ceremonies were

held at the Normandy House on February 4. On that date, 18 new men were inducted into Phi Lambda Kappa in an impressive ceremony. Over 75 men were present at the dinner.

With all the new students in our chapter, plans for the spring are now underway.

Phi Delta Epsilon

The Phi D. E. year at Chicago Medical School began auspiciously with a brilliant lecture on "Surgery of Congenital Neoplasms in Infancy and Childhood" by Dr. Robert Gross of Boston. This lecture, the first annual John J. Sheinin Lecture given in honor of our illustrious President, was a great success. This was followed by a dinner tendered Dr. Gross by the three Chicago chapters and the Graduate Club. The next event on the schedule was the Smoker at the Furniture Club, and a party at the Midwest Hotel. The latter produced some of the most spirited community singing yet perceived in the Chicago Medical School community. The fall season closed with the visit of several fraters to the New York convention festivities, there joining Perry Gross, the Senior Senator. The winter quarter saw a dance at the Illini Union held in conjunction with the Illinois chapter. The tri-chapter affair, headlining initiation of Chicago Medical School, Illinois, and Northwestern pledges, was again held at the Furniture Club as a formal dinner-dance. Fifteen new fraters were acquired at that time, and eight promptly retired for a week with influenza.

This quarter also saw the inception of dinner meetings, monthly affairs at selected local restaurants, with faculty guests presenting talks on medical subjects. Dr. Maurice Cottle, chairman of Otolaryngology at Chicago Medical School, was the first after-dinner speaker, sharing the dais with Dr. Louis Shabat, the newly elected faculty adviser. Dr. Shabat, as well as Dr. Milton Eisenstein, District Deputy Grand Council, and Dr. Jack Sloan of the Chicago Graduate Club, were elected honorary members of the Beta Tau chapter. Drs. Shabat and Eisenstein are in The Chicago Medical School Surgery Department.

